



REPUBLIC OF SOUTH AFRICA

ANNUAL REPORT

of the

Secretary for Agricultural

Technical Services

for the period

1 July 1971 to 30 June 1972

Published by Authority

Price: R4,25

Overseas: R5,30

Post Free

Printing costs: R1969,03

Number printed: 1 000

RP 18/1973

ISBN 0 621 00346 8

REPUBLIC OF SOUTH AFRICA

ANNUAL REPORT

of the

Secretary for Agriculture

Digitized by the Internet Archive
in 2025

for the period

1 July 1971 to 30 June 1972

Report of the Secretary for Agricultural
Technical Services for the period
1st July, 1971, to 30th June, 1972

THE HONOURABLE THE MINISTER OF AGRICULTURE,
P R E T O R I A .

SIR,

I have the honour to submit herewith the Annual Report of the
Department.

W.A. VERBEEK

Secretary for Agricultural Technical Services

Contents

	Page
1. INTRODUCTION	1
2. EXTENSION AND EDUCATION	5
Agricultural extension	5
Agricultural education	11
Publications	12
Audio-visual services	13
Radio	13
Information bureau	14
Library service	14
3. THE NATURAL RESOURCES	15
Soil conservation	15
Soil fertility	25
Natural grazing	31
4. FIELD HUSBANDRY	44
Maize	44
Wheat	47
Oats	49
Barley	50
Grain sorghum	50
Cotton	51
Groundnuts	54
Sunflower	55
Guar beans	55
Soya beans	56
Dry beans	56
Chicory	56
Rice	56
Sisal	57
Phormium	57
Pyrethrum	57
Potatoes	57
Tobacco	63

<i>Artificial pastures and forage crops</i>	67
Lucerne	67
Clover	68
Other forage crops	68
Drought forage crops	71
 5. HORTICULTURE	 72
Deciduous fruit	72
<i>Winter Rainfall Area</i>	72
<i>Summer Rainfall Area</i>	77
Table grapes	80
<i>Winter Rainfall Area</i>	80
<i>Summer Rainfall Area</i>	82
Wine grapes	82
Citrus	99
Subtropical fruit	103
Strawberries	111
Flowers and ornamental shrubs	112
Nuts	114
Vegetables	116
 6. THE LIVESTOCK INDUSTRY	 122
Beef cattle	122
Dairying	127
Sheep and wool	135
Goats and mohair	142
Pigs	143
Fowls	146
Waterfowls	148
Ostriches	148
Horses	148
 7. VETERINARY SERVICES	 149
Introduction	149
Notifiable diseases	150
Non-notifiable diseases	156
Other veterinary research	172
Vaccine production	179
Other veterinary services	180

Health schemes	182
Food hygiene	182
Stock inspection services	183
Animal health extension service	183
Import and export control	184
Training	186
Stock census	186
Legislation	186
Technical relations with other countries	187
 8. AGRICULTURAL ENGINEERING	 189
 9. ADDITIONAL SERVICES	 198
Plant studies	198
Seed control	201
National collection of insects	207
Control of other pests	211
Insect control and research	213
Beneficial insects	217
Mycology	220
Legume research	221
Meteorological research	222
Agricultural technical relations with foreign countries	224
Personnel development	232
 10. ANNEXURES	 239
(1) Organisation and function of the Department	239
(2) Agricultural education	245
(3) Finances	246
(4) Buildings	248
(5) Scientific publications	248
(6) Popular publications	263
(7) Non-departmental publications	267
(8) New legislation	270

1. Introduction

South Africa has not remained unaffected by the world-wide agricultural revolution which has gained momentum since the Second World War. The scientific, technological and socio-economic aspects of present-day agriculture oblige both the farmer and the authorities to review their respective contributions at shorter and shorter intervals and to make adjustments.

We in the Republic have recently been made aware of the extent to which crises in the agricultural sector have assumed new dimensions. As a result of these crises the Department of Agricultural Technical Services is faced with challenging situations. Holding, as it does, a mandate from the authorities to protect, stabilise and promote, in the broadest sense of these words, our national agricultural industry, the Department has an extensive and difficult task.

Because it has taken a critical view of the services rendered by it, and is fully aware of what is required of it, the Department has consistently tried to adapt itself to the dynamic nature of agriculture so that it might be able to meet the challenges of the times. For this reason the Department has devised a specific organisational structure and developed a particular working method to enable it to tackle its task in a systematic manner.

The promotion of agriculture requires knowledge — scientific knowledge of basic problems and technological knowledge for the solution of the problems. Apart from the contribution which it makes to our national economy, agriculture is therefore also a science, which, by virtue of its inherent diversity, covers a wide field, including the soil, moisture and nutritional media for the crop and animal industries of the country.

The Department's approach to this extensive task has four main elements: research, which is aimed equally at the acquisition of knowledge for the solution of recognised problems and at the development of unexploited production potential, extension, which is aimed at identifying and overcoming practical problems; the training of both would-be and practising farmers; and the administration, on the one hand, of legislation and regulatory services flowing from this dispensation, and, on the other hand, of the necessary staff.

RESEARCH

The research conducted by the Department of Agricultural Technical Services is not only the most extensive in the Republic, but also embraces the widest

range of basic and applied disciplines. The research division tries to examine problems connected with agricultural production both in depth and in breadth: from the laboratory bench with its highly sophisticated apparatus to the field trial which is always subject to the vicissitudes of the particular environment.

To achieve this, research work is divided into two categories. Basic problems of national importance fall to eleven Institutes that deal with specific subjects or are linked with particular industries, while problems that are more local and arise in every-day practice are the particular responsibility of eight regional organisations. But there must of necessity be close co-operation between the Institutes and the Regions. For instance, there are 2 126 registered research and development projects that have to be co-ordinated, and this co-ordination is effected by a controlling, centrally situated Directorate of Agricultural Technical Services.

Agricultural research, like research into the majority of biological subjects, is for the most part a long-term undertaking. There is seldom a dramatic end result, because one project generally leads to another and more often than not the solution of any one problem brings to light a number of related problems that also justify investigation.

It is for this very reason that knowledge of agricultural problems cannot readily be taken over from outside, as can be done in the case of many pure sciences. To this must be added the fact that the majority of problems are regional in character, which necessitates investigations on the spot. These circumstances necessarily lead to a high cost structure, and make it difficult to determine precisely what the specific contribution of agricultural research is.

In a rapidly developing country it is essential that research should not be restricted to contemporary problems. It is important that research should be aimed at goals that are in keeping with the needs both of the Republic and of other countries. Purely economic considerations make it imperative that research maintain uninterrupted contact with producer bodies and marketing organisations. Such contact is established through Departmental representation on the majority of the Control Boards and by means of Advisory Committees for the most important industries on which all bodies with a direct interest have representation.

It is through these contacts, among others, that the Department is constantly made aware of

competitive elements in international trade, and of the increasingly sharp competition between natural foodstuffs and fibres and their substitutes.

EXTENSION

The key figure in the extension activities of the Department is the extension officer who is stationed and works in a particular farming area. His task embraces far more than the mere handling of day-to-day farming problems. He is expected to know the local farming community and the agricultural potential of his area so well that he can get optimum agricultural production through optimum land use.

To do this, he needs not only professional knowledge and a knowledge of the particular area and its soil, climate and vegetation, but also a thorough understanding of the people in their particular farming circumstances.

If optimum use is to be made of the land, the type of farming that is practised must be related to the true potential of the natural resources, it must be the right branch of farming for the particular area, and it must be practised in such a way that it will keep the farm physically stable and provide the farmer with economic stability.

But although the extension officer is in the front line, optimum land use is a policy that affects every compartment in the extensive organisation of the Department of Agricultural Technical Services.

And as we expand our knowledge of South African agricultural resources on the one hand, and of the national and international requirements on the other, it becomes all the more necessary that a directive policy be formulated and applied. Everyone concerned in South African agriculture should never lose sight of the fact that in our case rain is the greatest single limiting factor and that our natural grazing is and will remain the most vulnerable constituent of our agricultural resources.

Under these circumstances the extension officers always have to bring the most pressing problems in their areas to the notice of the authorities. From this flows such functions as organised soil protection, formal control of diseases and pests, or Government assistance to farmers.

This also explains the establishment of Divisions for regulatory services within the Departmental framework and underlines the necessity of close co-operation with other Government Departments such

as the Departments of Agricultural Economics and Marketing, Agricultural Credit and Land Tenure and, Water Affairs and with statutory scientific bodies.

But extension cannot be entirely divorced from research. The extension officer relies to a large extent on the research worker for specialised or new knowledge of his subject, while the research worker looks to the extension officer for the identification and evaluation of his problems. These groups are brought together in development programmes in which each group ultimately plays its part. For this reason it is sound practice to have extension officers working alongside of this type of research worker in a single Regional organisation.

But there are specific tasks, not included in the aforementioned functions, which can be undertaken by extension officers only. Some of these tasks are of a technical nature, while others have a socio-economic purport. It is necessary, therefore, when matters such as soil conservation works and subsidy inspections are dealt with, that the professional officers should have highly skilled technicians to assist them.

TRAINING

Ever since they were established post-school agricultural colleges in South Africa have been the direct responsibility of the Department of Agriculture. Of necessity, training at agricultural colleges has a practical bias, because its primary object is the training of would-be farmers. It is imperative, therefore, that, apart from their ability to inspire and provide young people with clear goals, those officers responsible for the training function should keep in close touch with practical farming.

Over the years it has been found that most of the farmers who obtain diplomas become the formal and informal leaders in Organised Agriculture and in other spheres. To them, the college is their alma mater, and this fact results in reciprocal contact being established and maintained. Just as important as the regular contact between the farmer and the source of knowledge is the permanent contact between the Department and the farming community in our country. In the absence of such contact there will naturally be a lack of faith, a situation which must never be allowed to arise.

But the Department's training function extends far beyond its six agricultural colleges. Farmers' days, short courses and study groups are traditional aids in training, and they help, *inter alia*, to make joint action by research workers and extension officers possible. These institutions are adapted to the needs of a particular area or time.

It is preferable that gatherings held to deal with particular problems should take place in the production area, within easy reach of the farmer. On the other hand, numerous farmers' days are held at Departmental institutions, where the latest research findings are made known and where results can be convincingly demonstrated.

Apart from the above-mentioned training methods, the Department continues to present formal short courses, mostly at its agricultural colleges. In the main, these courses are devoted to subjects involving skilled techniques, such as artificial insemination of cattle or sheep, or the grading of cereals. In this way a farmer who has not had previous training is constantly afforded an opportunity of increasing his knowledge under expert guidance.

But apart from its obligations to farmers, the Department also has to train its own staff. This in-service training varies from the secondment of officers to universities or colleges for advanced technical study so they may become better equipped for their tasks, to the presentation of short courses in, for instance, administrative procedures or specialised new fields of activity.

It has also remained the Department's policy to send officers to other countries to attend national or international specialist conferences. The reports on these conferences are circulated throughout the Department to ensure that they are read as widely as possible.

ADMINISTRATION

An organisation with an establishment of more than 6 600 posts, more than 3 300 of which are technical or professional posts, can hardly function smoothly without strong administrative support. The Department's annual budgetary provision for its various undertakings runs to more than R50 million. In addition, the Department is concerned, directly or indirectly, with the entire turnover of agricultural products, which came to the huge sum of R1 657 million in 1971/72.

The administrative branch includes a section which is responsible for administering a total of 23 national statutes into effect and keeping them up to date. This highly specialised service leaves the professional staff free to concentrate on professional and technical matters.

The Department's regulatory divisions, which are concerned with soil protection and the control of plants and seeds, as well as the Veterinary Services Division, necessarily have to maintain a close liaison with this administrative section.

INFORMATION

The Department tries to maintain rapid and efficient communication with outside bodies and persons; the media used include the press and the radio. In this connection the Department's Agricultural Counsellors in Paris, London, Washington D.C. and Buenos Aires play an important part in keeping agriculturists in this country abreast of the latest agricultural developments in other countries. International contact and dialogue with neighbouring states and overseas countries, are also promoted through the constant liaison of the Department's agricultural scientists.

The methods of communication used have regard to the fact that the findings of agricultural research usually require several adjustments before they can be applied on a particular farm. The results of scientifically planned and executed research are released scientifically in the first instance — hence the various authoritative scientific journals with world-wide circulation that are published by the Department with the object of establishing communication between specialists in particular fields (*Agroanimalia*, *Agrochemophysica*, *Agroplantae*, *Flowering Plants of Africa*, *Bothalia*, *Onderstepoort Journal of Veterinary Research* and *Phytophyllactica*).

The second step is to establish communication between the research worker and the extension officer, and this is accomplished by means of technical communications and bulletins.

Finally, it is essential that information be presented to the farmer in an appropriate and readable form. To this end pamphlets and leaflets, which are brief and to the point, are produced strictly according to need and distributed only among those readers who have a real interest in them.

The radio is an indispensable medium in this set-up, and is used primarily to present new information. For this reason a daily talk is given in conjunction with a news service for the general and the agricultural press. Because of the specialised nature of the modern communications system, this task, too, has been entrusted to skilled specialists, but within the framework of the Department of Agricultural Technical Services.

Before leaving this subject, mention must be made of the library facilities. Besides a central library of agricultural works at its head office, the Department has branch libraries in all its institutions throughout the country. Taken as a whole, this complex undoubtedly constitutes the greatest single collection of books on agriculture on the African continent.

The library service has a twofold function: in the first instance it has to provide library facilities for the professional and technical staff of the Department, and in the second instance it has to provide the South African farming community with books and periodicals. Close liaison with other libraries in the country ensures that literature on practically any subject, both inside and outside the field of agricultural science, can readily be supplied to interested parties.

CONCLUSION

The Department of Agricultural Technical Services is a dynamic institution that must necessarily keep abreast of the latest scientific and economic developments and must continually plan ahead. Frequently, the Department is also responsible for development that follows on its planning, as witness the large irrigation schemes which are at present being planned and developed by the Agricultural Engineering Division and the Soil and Irrigation Research Institute in conjunction with the regional organisations concerned.

It is for this reason that internal adjustments within the Department are imperative, and that the Department must maintain constant contact with science and the agricultural industry. As in all other branches of science, developments in agriculture take

place with bewildering rapidity. But the more progress one makes, the more complex and the more difficult of solution the remaining problems become.

If South Africa is not to lag in this race, it is essential that the Department's organisation should be administered at the highest possible level and that its personnel should consist only of the ablest men.

If our agriculture is to satisfy the needs of our own people, whose living standards are continually rising, as well as those of our export markets, which are becoming more insistent upon quality, only the very best will be good enough.

The task of the Department can be summarised as follows: to collect through close co-operation of all its divisions, institutes, and regional organisations, all the information necessary for a determination of the potential of the Republic's agricultural resources, to define the various natural farming areas clearly; to undertake regional planning and development; to plan and promote the balanced development of farming; and to assist in the formulation of the best policy on the planning of production with due regard to supply and demand, both locally and overseas.

This is the challenge which the Department of Agricultural Technical Services has to meet, and in the following chapters the reader can learn in greater detail how this challenge is being met.

2. Extension and Education

AGRICULTURAL EXTENSION

By using varying methods and techniques, the Extension Service performs the important function of transmitting information about agriculture to the farmer. The aim of the Service is becoming more and more to work *with*, instead of merely *for*, the farming community. The object is to help the farmer to help himself.

A statement of the main activities of the Extension Service during the year under review follows:

Activity	Number	Number of farmers reached
Farmers' days		
Farmers' days organised by Departmental officers or in which they participated	365	2 013
Lectures delivered by Departmental speakers at farmers' days	789	
Demonstrations given by Departmental officers at farmers' days	115	
Lectures		
Lectures given on occasions other than farmers' days	1 873	41 928
Number of lectures for which visual aids were used	107	28 717
Courses		
Departmental courses held in extension areas	199	4 961
Co-operative demonstrations and projects		
Co-operative demonstrations in progress	388	
Meetings held at demonstration plots	137	1 991
Other agricultural demonstrations	91	1 367
Co-operative research projects laid out during the year	74	
Total number of co-operative research projects in progress	128	
Farm visits and interviews with farmers		
Farm visits by Departmental officers	81 595	81 595
Follow-up visits in connection with farm planning	12 865	12 865
Personal interviews in extension offices	78 678	78 678
Other personal interviews	25 917	25 917
Telephone interviews	108 435	108 435
Correspondence		
Personal letters sent off	20 669	20 669
Circulars sent off	737	139 375

Shows

Shows held in various extension areas	211
Officers who acted as judges or supervisors	337
Exhibitions organised by Departmental officers at shows or other functions	15

Farming competitions

Farming competitions held in extension areas at which Departmental officers acted as judges	124
Competitors	961

Other statutory services

Farms inspected for the Land Bank	56
Farms inspected for the Department of Agricultural Credit and Land Tenure and the Agricultural Credit Board	1 775
Farms inspected for the Department of Planning	252
Farms inspected for other Departments	329

Inspections in terms of the Weeds Act

Properties inspected	19 739
Notices served	2 943
Prosecutions instituted	
Re-inspections after notices had been served	3 750

Individual and group contact methods are still the surest and most successful way of reaching the farmer and bringing scientific practices to the individual farming unit. These methods, therefore, constitute a large part of the activities of the Extension Service.

Newsletters, which are issued for extension areas or Regions, are increasing in popularity, largely on account of the more intimate tone adopted.

New trends

There is an increasing tendency to give priority to certain areas where the agricultural conditions justify this, without denying Departmental services to persons living outside these areas who wish to make use of them.

The boundaries of such areas are determined, firstly, by the hydrography and, secondly, by the composition and size of natural locality groups or farming communities.

Broadly speaking, this new approach is based on the following considerations:

1. Hydrographic planning is an important part of agricultural development. The country's topography and the average farm size are dependent on each other for the control of run-off. Communal watercourses crossing several farm boundaries should therefore be decided on in advance in respect of a given catchment area or subcatchment and the hydrographic planning of individual farms should be adjusted accordingly. Unless the hydrographic planning of an area as a whole is undertaken problems may arise, as planning an individual farm without taking the circumstances of the neighbouring farm into account may mean that while water is controlled effectively on one farm the run-off causes washaways on a neighbouring farm.
2. Farming communities form active units on their own; a fairly strong bond develops between the individuals in the unit, and they influence each other. This means that they can be more effectively drawn into extension processes as a group.

Experience has proved that when the implications of area planning (including the re-surveying and rebuilding of existing protective structures as a result of the planning of the area as a whole) are explained to the farmers concerned they not only welcome the new approach, but are even eager to apply it.

The explanation for this is undoubtedly the better insight and perspective that follow when the proposed contours and communal watercourses of an area are mapped and shown to the farmers.

As regards extension methods the so-called "mini" farmers' days, intended for a relatively small group of about 25 farmers, are gaining in popularity, especially in the Transvaal Region. The principle here is to hold the farmers' day for a circumscribed area, confine the subject of the day to a topical subdivision of a wider subject and give the farmers a far bigger share in the proceedings by means of group and panel discussions. This method is very promising.

Programme development

The development and implementation of separate agricultural development programmes with clearly-defined and measurable goals, involving groups of farmers with the same problems, is meeting with more and more approval. This method is gaining ground at the expense of the practice of assisting farmers individually with isolated problems in connection with various branches or subdivisions of farming.

At present there are 182 programme planning committees with a membership of almost 1 628. In many cases soil conservation committees perform all some of the functions of planning committees. So far 180 programmes during the past year had a variety of agricultural aims. Most programmes were concerned either directly or indirectly, with some aspect of soil conservation. Second in importance were programmes aimed at some aspect of production, and other programmes were launched to evaluate a definite situation or to determine the extent of some agricultural problem.

Progress with programmes

In the *Highveld Region* a maize cultivation programme was started in 1963 with 65 farmers and concluded during 1972. The aim was to improve the application of selected maize cultivation practices.

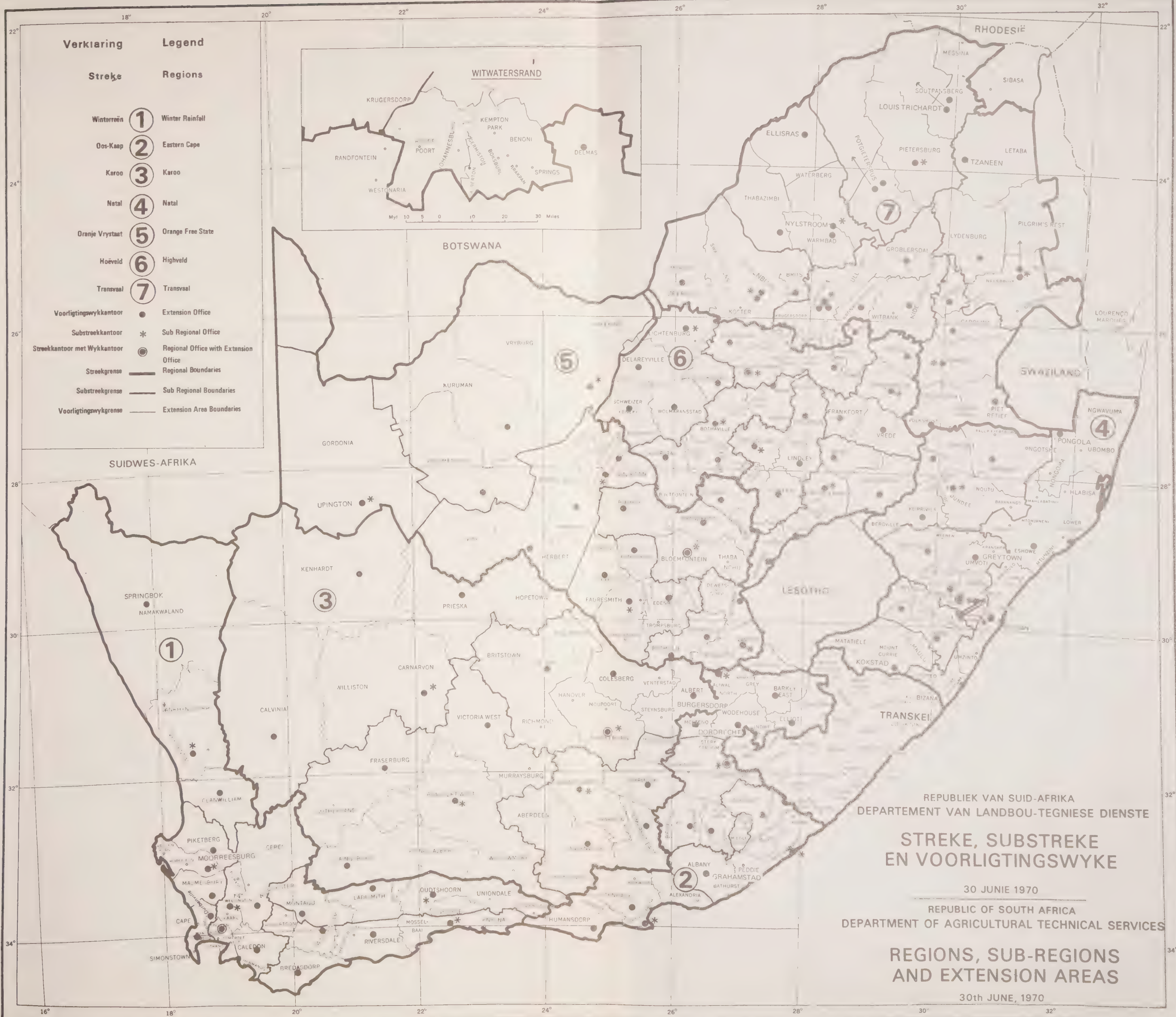
The results were as follows:

Maize cultivation programme – Lichtenburg

1963 – 1972

	% of farmers applying the practice at the beginning of the period (1963)	% of farmers applying the practice at the end of the period (1972)
1. Planting first-year hybrid seed	54	84
2. Light grazing of maize stubble	18	56
3. Winter ploughing of fields	56	40 ¹⁾
4. Phosphate fertilising according to potential	34	64 ²⁾
5. Application of at least 40 kg of N per ha	30	64
1) Fields could not be ploughed in winter owing to drought.		
2) Progress was made only during the last three years		

Owing to the drought there was a decrease in the number of farmers who ploughed their fields in winter, but the number of farmers applying the other practices not only increased considerably as a result of the programme, but doubled in some cases and even more than doubled, as in the case of light autumn grazing of maize stubble.



SUIDWES-AFRIKA SOUTH WEST AFRICA

- 
 Hoofkantoor en Substreekkantoor/
Head Office and Subregional Office
- 
 Landboukollege/
College of Agriculture
- 
 Navorsingsstasie/
Experimental Station
- 
 Voorligtingskantoor/
Extension Office
- 
 Substreekkantoor/
Subregional Office



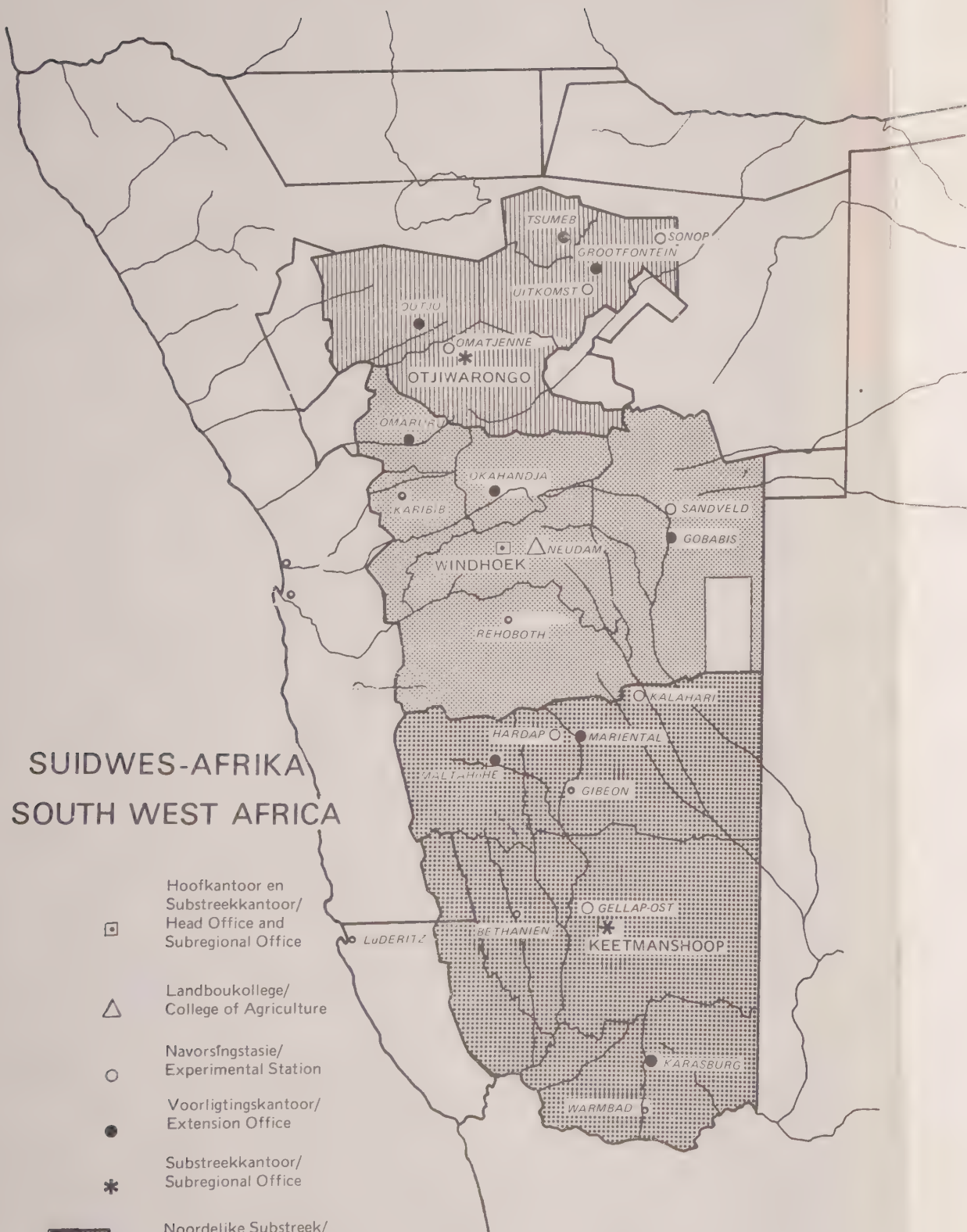
Noordelike Substreek/
Northern Subregion



Sentrale Substreek/
Central Subregion



Suidelike Substreek/
Southern Subregion



As a result of the application of these improved practices the production of maize rose from 14 bags per ha in 1966 to 22 bags per ha in 1971 — an increase of 57 per cent in five years.

In addition the following results of the programmes were reported:

On 22 farms damaged land was withdrawn from grazing.

In one area goat numbers were reduced from 3 500 to 2 600.

In one maize district the knowledge of 30 farmers about fertilising maize (in terms of the percentage of correct answers given) rose from 60 per cent to 71 per cent over a period of a year, or, expressed differently, the percentage of farmers able to give 70 per cent or more correct answers in a questionnaire on fertilising rose from 37 per cent to 70 per cent.

10 farmers classified and fertilised 30 ha of fields entirely according to soil potential differences.

The difference in the yield from this land and the best from the fields treated according to the farmers' standard practices was about 8 per cent, with an increased net profit of about R6,00 per ha from the land fertilised according to potential requirements.

From 1966 to 1972 the fertilising level applied by 7 of the 8 collaborators in a study group rose from about 70 kg of N, 50 kg of P and 20 kg of K to about 140 kg of N, 70 kg of P and 30 kg of K per ha, a fertilising level that is more or less in accordance with the potential requirements of the soils concerned.

The *Eastern Cape Region* in particular was able to report considerable progress with soil conservation.

In Adelaide the percentage of farmers applying various veld treatments increased as follows over a period of five years:

Percentage of farmers applying various veld treatments in the extension area of Adelaide (1967 — 72)

Treatment	Percentage of farmers				
	1967/ 68	1968/ 69	1969/ 70	1970/ 71	1971/ 72
25% of the veld rested for a full growing season or one year (Sept.-April or Jan.-Dec.)	49	52	49	80	76
Under 25% of the veld rested for a growing season or year and/or rest for half a season applied	29	41	46	15	16

This table shows that the percentage of farmers who rested a quarter of their veld for a full growing season increased from about 50 per cent to over 75 per cent over a period of five years, and that the number of farmers who rested less than a quarter of their veld decreased during the same period.

In Aliwal North the following progress with an erosion programme was reported:

Progress with the erosion programme in the Aliwal North extension area

1970 — 1972

	1970/71	1971/72
Eroded watercourses withdrawn from grazing	81,1%	94,8%
Poorly-covered mountain slopes withdrawn from grazing	65,1%	95,1%
Eroded patches on rises and plains that were rested	55,0%	65,0%
Total area of eroded land fenced off	62,5%	65%

The increase in the process of withdrawing eroded watercourses and poorly-covered mountain slopes from grazing was particularly striking, and the withdrawal of eroded patches from grazing also showed good progress.

Results of other programmes were as follows:

- (i) The percentage of veld (as a percentage of all pasture) rested in Aliwal North increased from 16 percent in 1965/66 to 48 per cent in 1971/72. One may deduce from these data that the farming community is beginning to realise the importance of resting veld.

- (ii) The stocking rate (expressed in terms of small stock units per ha) in Aliwal North dropped from 1,15 to 0,60 over the period 1967/68 to 1971/72, which means that a better balance was achieved between the stock numbers and the carrying capacity of the veld.

The reasons for these changes were:

- (a) drought, which brought about a reduction in stock numbers,
- (b) the effect of the Stock Reduction Scheme, and
- (c) a more realistic conception of the actual carrying capacity of the veld among the farmers.

- (iii) From 1967 to 1972 the large stock: small stock ratio in Aliwal North dropped from 1 : 12,8 to 1 : 7,9, which is a far healthier ratio.

There is every reason to believe that farmers are now more interested in and concerned about the veld.

In the *Karoo Region* 1 000 ha of spineless cactus was planted in the districts of Jansenville, Steytlerville and Aberdeen, after a programme to promote the planting of drought-resistant forage crops was started 18 months previously.

The training programme for soil conservation committees is still in progress and subjects such as the duties and functions of committee members, veld management practices, catchment planning and the techniques of plant surveys will be dealt with during the coming year.

Situation determinations in respect of the treatment of waterway camps and the grazing intensity on farms were recorded for six soil conservation districts. The survey data for the remaining 44 soil conservation districts will be summarised in the form of a report during the coming year.

The programme aimed at entering complete records of all landowners in the Region on index cards is progressing well. Cards for 1 656 farmers have already been completed.

The following progress with programmes was reported from the *Winter Rainfall Region*:

1. On 12 farms 24 camps under cultivation with an area of 868 ha were contoured, and the contours of two camps were supplied with waterways.
2. Two avenues were established and fenced off.

3. On six farms permanent strips of veld were introduced in 12 camps that are susceptible to erosion.
4. From 1968 to 1972, 426,20 km of contour banks were completed on 2 831 fields in the Vredenburg koppie veld.
5. In Koringberg the following short-term aims were achieved after one year:
 - (a) Fields susceptible to erosion on four farms were fully contoured.
 - (b) Seven camps under cultivation contoured on four farms.
6. During the period 1968/69 to 1971/72, 51 waterways with a total length of 20 610 metres were stabilised on 44 farms.
7. As a result of a programme relating to Turkish tobacco launched at Stellenbosch, 46 new producers entered the industry in 1972, which meant an increase of 50 per cent in the number of producers in four new production areas.
8. In the South Coast Subregion 623 km of contours were completed, protecting 3 853 ha of fields.

The progress made in the *Free State Region* included the following:

1. In a group of farmers taking part in an extension programme, the number of farmers who applied a three-camp grazing system increased from 33 to 50.
2. A campaign to promote the planting of buffalo grass *Cenchrus ciliaris* resulted in 27 farmers planting this species. Eight of these farmers planted over 10 ha.
3. The result of a planned grazing programme for 78 members of soil conservation committees was that the percentage following a planned grazing system increased from 32 per cent to 53 per cent in one year.
4. In two extension areas 90 active collaborators were recruited to keep veld, stock and field records.

In addition to the progress described above several situation determination programmes relating to matters such as the extent to which farm planning and grazing control practices are applied and the position of sultana farming along the Lower Orange, were launched.

The value of programme development lies chiefly in the more orderly manner in which the Extension Service and the farming community are able to tackle

agricultural problems at the extension area level, and in order of importance. Programme development also contributes to a better spirit of co-operation between the Departmental officer and the farmer and offers good prospects of measuring progress in terms of concrete data.

Programme development is becoming increasingly important as a method of work and in future more and more attention will be given to it.

Study groups

There are now almost 272 active study groups with 3 131 members. During the past year 1 114 meetings were held.

Study groups, by their very nature, undertake studies of problems as they occur in their areas. In addition to economic studies undertaken under the mail-in records systems, a wide range of subjects were studied during the past year, including the following:

Viticultural practices, sheep management practices, dairy production, beef production in dairy herds, dryland lucerne, increasing maize and wheat yields, artificial pastures, veld management practices, drought feed crops, Merino breeding practices and fertilisation studies.

As in the past, it is apparent that study groups are dependent for their survival on the professional guidance of the extension officer and other experts.

Conservation farming competitions

Conservation farming competitions are now not as popular as they were in the past, but they nevertheless play an important part in keeping interest in soil conservation alive.

During the year under review about 54 competitions were held, and 439 farmers participated. Successful farmers' days were held on the farms of some of the prize winners.



A short course in pasture science for farmers in the Outjo district of South West Africa

The principles of grazing control are elucidated in the course of a Farmers' Day on a farm in the Albany district, Eastern Cape



Extension research and surveys

In addition to surveys undertaken to evaluate the results of programmes, the following studies were undertaken:

- (1) With the co-operation of the extension officer at Piketberg and Clanwilliam a survey was carried out on 80 farms in order to determine the present extent of buchu production, price trends and cultural practices.
- (2) A comprehensive survey study of cultural practices for wine grapes at Stellenbosch was completed and is at present being processed to establish why major differences in wine production occur on comparable great soil types. Production varied from 3 to 20 tons per ha on alluvial soils, from 4 to 14 tons on loam, from 3 to 22 tons on granite, from 4 to 16 tons on sandy and gravelly soil and from 5 to 15 tons on shallow soils.
- (3) A survey in the Ceres district to establish how far erosion has advanced on cropland is nearing completion.
- (4) An interview schedule was prepared for a study of cultural practices in Caledon and a survey will be undertaken next year.
- (5) A survey in the Ceres-Karoo to investigate the veld cover and planning requirements has been completed and is being finalised at present.
- (6) The extension officers at Worcester and Stellenbosch have started practice studies in connection with apple and wine grape cultivation.
- (7) The extension officer at Fauresmith is working on a research project on the agricultural potential of that area.
- (8) At Vaalharts an evaluation study was undertaken to determine the impact of the local extension newsletter "Die Landbouer". It was found from a random sample of 350 farmers that over 95 per cent read it fairly intensively, and 91 per cent were prepared to pay for it if necessary.
- (9) Studies on the agricultural potential of the North-Western Transvaal sweet bushveld and the effectiveness of agricultural extension in the South-Eastern Transvaal were completed.
- (10) A survey on a potential study of the Springbok Flats was completed and the data are being processed.
- (11) An extensive survey of the farming situation in the various farming regions of Natal was undertaken, and research and extension priorities can now be established.
- (12) The agricultural and sociological problems of small farming units in the Upper Orange catchment were investigated.
- (13) In the Highveld Region progress was made with the land use project. On the basis of 50 wheat and 40 grain sorghum yield studies, yield standards could be laid down for various soil types.
- (14) A start was made with 14 sunflower yield studies, which are to be extended in the course of time to include the determination of new standards for this crop for the various soil types.
- (15) On the basis of the results obtained in these and other studies, the Field Husbandry Section of the Region designed elementary grain yield calculators, based on the principle of the slide rule in circular form. These calculators obviate the necessity of calculating the yields of various types of grain on certain soil types under various climatic conditions according to formulas.

Liaison

There is regular liaison between officers of the Department and soil conservation committees of the extension area level and also at the Regional level. At the same time there is an excellent relationship between the officers of the Regions and members of organised agriculture.

Meetings of soil conservation committees are held regularly and attended by by officers. Attendance is generally satisfactory.

In a few cases coursed were offered to soil conservation committees to equip members better for their task. Some extension officers use soil conservation committees as programme planning committees.

Regional advisory committees meet from time to time under the chairmanship of the Regional Directors concerned and subjects such as the motivation of the farming community with regard to conservation farming, Regional development programmes, problems connected with the application of the Soil Conservation Act, ways of increasing the efficiency of committees, the identification of offenders, etc., are discussed.

In-service training

In order to acquaint the staff of the field services with the latest developments in the field of agricultural science and with administrative matters, regular in-service training services are provided.

The following courses were held in the *Highveld Region*:

- 1. A three-day course on the planning, design, construction and maintenance of soil conservation works for 25 technicians.
- 2. A two-day course on taxonomic soil classification for Chief Extension Officers and Extension Officers.
- 3. A two-day course on merit assessment and staff reports for all Assistant Directors, Control Technicians and Chief Technicians.

In the *Winter Rainfall Region* a course on soil classification and mapping was held for officers from the field services and from the Fruit and Fruit Technology Research Institute and the Oenological and Viticultural Research Institute.

In the *Natal Region* officers attended courses on communications, subtropical fruit, fertilisation and linear programming.

Officers from the *Transvaal Region* attended successful courses on grazing and soil classification.

On account of the increasing interest in viticulture in parts of the Free State Region, two Chief Extension Officers, six Extension Officers and one Senior Technician paid a fourteen-day visit to the Western Cape for training in the selection of vine propagation material. At the same time 12 technicians attended a short course on the design of stock watering systems.

In the *Karoo Region* 16 technicians attended a short course on soil conservation.

AGRICULTURAL EDUCATION

Student numbers at Faculties of Agriculture and Colleges of Agriculture were as follows:

Student numbers at Faculties of Agriculture, 1972
(Numbers for the previous year in brackets)

Faculty	Undergraduate (1st – 4th years)	Post-graduate
Natal	191 (197)	62 (49)
Stellenbosch	251 (272)	103 (109)
U.O.F.S.	128 (150)	58 (60)
U.P.	260 (210)	128 (132)
Total	830 (829)	351 (350)

Degrees in agriculture awarded, 1971 and 1972 (Numbers for the previous year in brackets)

	B.Sc.	B.Sc.	M.Sc.	D
Natal	41 (41)	-	18 (7)	- (5)
Stellenbosch	45 (39)	29 (33)	16 (15)	4 (4)
U.O.F.S.	32 (35)	8 (9)	10 (10)	4 (1)
U.P.	33 (51)	9 (9)	6 (14)	7 (8)
Total	151 (166)	46 (51)	50 (46)	15 (18)

Degrees in veterinary science awarded, 1971 and 1972
(Numbers for the previous year in brackets)

	B.V.Sc.	M.V.Sc.	D.V.Sc.
U.P.	36 (42)	2 (2)	(2)

It is apparent from the table given above that numbers have remained fairly constant during the past two years and this may be a turning point in the decline in interest in agriculture.

Student numbers at Colleges (Numbers for the previous year in brackets)

College	Number of students
Cedara	115 (65)
Glen	59 (53)
Grootfontein	27 (50)
Neudam	33 (33)
Potchefstroom	107 (66)
Stellenbosch- Elsenburg	100 (46)
Total	441 (313)

Training at the colleges of agriculture is still fulfilling a need and attendance at these courses rose considerably during the year under review.

Only the Glen and Neudam colleges shall offer a one-year course. The other colleges have all changed to a two-year diploma course.

Short courses offered by colleges

College	Number of courses	Attendance
Cedara	4	36
Glen	19	570
Grootfontein	3	140
Neudam	10	163
Potchefstroom	27	603
Stellenbosch- Elsenburg	4	62
Total	67	1 574

There is a definite need for this type of training in the farming community and a wide variety of courses is presented every year.

The short courses on artificial insemination and grain grading, which are almost an institution at the Potchefstroom College of Agriculture, are still enjoying considerable support, and certain other short courses, especially one on dairy farming and beef production, are well attended.

At the Stellenbosch-Elsenburg College of Agriculture the course on Dormers is well supported, and the course on artificial insemination and one offered specially for Dormer breeders drew 19 students.

A fairly wide variety of short courses was offered at the Glen College of Agriculture, including courses on Karakul, mutton Merinos, judging of Afrikaner cattle, cream grading, artificial insemination and dairy cattle farming.

The Cedara College of Agriculture presented a number of short courses on artificial insemination, and the Grootfontein College of Agriculture held courses on Dorper mutton sheep, maintenance of tractors, welding and fleece testing. The course on fleece testing was attended by 103 students.

At the Neudam College of Agriculture in South West Africa a successful refresher course on Karakul farming was presented and attended by 33 students.

In addition to the short courses presented at the various agricultural colleges, a number of courses were held at various places in the Regions.

In the Highveld Region courses on balanced land use were continued — four courses were presented and were attended by 227 farmers.

The Winter Rainfall Region held 14 courses on wool and drew 288 farmers.

The Karoo Region presented one training course for irrigation farmers and 471 farmers attended. In all 40 Whites and 70 Non-Whites attended the courses in agricultural engineering.

The Karakul short courses presented on research stations and farms in South West Africa in co-operation with farmers' associations, are still enjoying great interest and doing much to place the industry on a sound footing. During the year nine preliminary Karakul courses and one advanced course were presented and attended by 163 persons.

PUBLICATIONS

Popular publications

During the year under review 149 articles on farming matters were published in the monthly journal "Farming in South Africa" as well as 88 articles in the section "The Woman and Her Home". Of each of three series of articles, namely engineering test reports on planters, cattle scales and fertiliser spreaders, 20 000 reprints were made and distributed free to farmers.

A special colour supplement on the new plum Songold grown at the Fruit and Fruit Technology Research Institute was also reprinted and 10 000 copies were distributed. All these articles were very popular and elicited enquiries from all over the country. In addition, reprints were also made of another 32 articles. Limited numbers of these articles were made available to Regions and Institutes for distribution to interested farmers.

During the year a Departmental inquiry into the function of "Farming in S.A." was completed as a result of which it has been decided to cease publication of the periodical on 31 March 1973.

A total of 353 650 pamphlets and leaflets, 92 000 copies of the weekly newsletter *Agricultural News*, 26 850 other newsletters and 7 700 library lists were distributed. In addition three pamphlets with a total printing of 93 000 were supplied to the Wool Board for distribution to wool farmers as an annexure to its periodical "The Golden Fleece".

A total of 10 230 bulletins were sold and the Handbook for Farmers was completely sold out.

Two popular bulletins on vegetative propagation of subtropical fruit trees and ditch silos and bunkers were published. Various publications for other Departments were also edited and prepared for the lithographic printing process.

Apart from the Departmental annual report (1970/71), four editions of the quarterly journal "Agrekon" were prepared for the press for the Department of Agricultural Economics and Marketing, while for the Department of Forestry two bulletins and one edition of the periodical "Forestry in South Africa" were prepared.

Scientific publications

S.A. Journal of Agricultural Science – During the year 109 articles (81 English and 28 Afrikaans) were received, an increase of 5 compared with the previous year. Including 60 articles carried over from the previous year, there were 169 articles on hand. Of these, 88 were approved, 12 rejected, 3 withdrawn, 3 included in other articles, and 1 designated a Technical Communication, and 62 have not yet been disposed of.

Of the 88 articles approved, 76 were published, 12 being carried over to the following year. So the year under review ended with 12 approved articles being carried over, and 62 still being dealt with. Of the total of 74 articles carried over 1 was received during 1969/70, 7 during 1970/71 and 66 during 1971/72.

The backlog of outstanding editions was eliminated during the year under review.

Onderstepoort Journal of Veterinary Research – Six issues containing 34 articles appeared during the year, namely Volume 37 Nos 3 and 4 and Volume 38 Nos 1 to 4. Seven articles were carried over from the previous year and 21 new articles were received. Of these, 6 were published in Volume 37 No 1 and 7 in Volume 39 No 2. Both these editions had gone to press before the end of the year.

Other scientific publications – Other scientific publications appeared as follows:

Bothalia, Volume 10, No 3; blomplante van Afrika, Volume 41, parts 2 and 3; Entomology memoirs, Nos 24 and 25; and Technical Communications, Nos 56, 97, 98, 99, 100, 101 and 102.

AUDIO-VISUAL SERVICES

The Department again co-operated with the Departments of Forestry and Water Affairs with regard to exhibitions in Bloemfontein, Nelspruit, Pietermaritzburg and Goodwood. In addition, these three Departments organised slide shows on pollution in co-operation with the National Veld Trust all over the country. More than 70 000 visitors attended the shows either by invitation or of their own accord.

During the year 13 series of slides with synchronised sound were completed and progress was made with another 25 series in various stages of completion.

Three films started in the previous year, namely those on mountain catchment areas, the master farmers of South West and the subtropical fruit industry, were completed. Two of these films are also being shown in theatres.

RADIO

During the past year "Calling all Farmers" again made an important contribution to the promotion of the national agricultural policy of optimal land use. For this purpose several series of programmes in which farmers as well as agriculturists took part, were presented. Coverage was also given to the second report of the Commission of Inquiry into Agriculture. The stock reduction scheme was another matter that received extensive coverage in agricultural radio programmes.

The services of the Central Agricultural Library were presented to listeners from a new angle, and the listener response was excellent.

The policy of getting farmers to take part in programmes on a regular basis was such a success that farmers from all corners of the country were heard.

Sincere thanks is expressed towards the S.A.B.C. for their continued co-operation and the wide coverage given to agricultural matters in their daily broadcasts. The Department would also like to thank officers of other departments and farmers who made contributions to programmes.

INFORMATION BUREAU

The Information Bureau of the Section Agricultural Information is to be expanded into a documentation centre that can play an important part in the Department's effort to document information with a view to distributing it to farmers as well as agricultural scientists.

LIBRARY SERVICE

During the year under review a library questionnaire was sent to all the members of the library in order to ascertain how actively they make use of the publications in the library. The information obtained will be used to improve library services.

A library manual was compiled to serve as a guide in the administration of books and magazines in sub-offices, extension offices, research stations, etc., of the Department.

All research stations and extension offices were requested to send one copy of each publication issued by them to the Central Library in future. Their response to this request was very good.

The Department receives about 1 800 different periodicals. Annually about 7 500 copies are distributed to more than 400 addresses in the Republic at a subscription cost of almost R100 000.

It is intended to use a computer to order periodicals. The change-over has reached the stage where a start can be made with advising the computer.

Altogether 5 982 books were acquired or obtained through exchange and/or donations. Of this total 4 757 books went to branch libraries and 1 225 to the Central Library.

The Central Library lent out 10 156 books, 705 Government publications, 1 543 bulletins and 2 198 periodicals and made 2 703 photocopies available to users during the year under review.

A start was made with the extension of the bibliographical service, and a total of 3 286 literature references were supplied to officers of the Department and to farmer members.

3. The Natural Resources

SOIL CONSERVATION

Division of Soil Protection

The *chief task* of this Division is to protect the natural resources and ensure that agricultural production does not take place at their expense. The instrument placed in the hands of the Division to ensure that it will be able to perform this function properly and with authority is the Soil Conservation Act, 1969, as amended. The various assistance schemes under this Act are, therefore, administered by the Division of Soil Protection. Besides the Soil Conservation Act, the Division is also responsible for administering the Weeds Act, 1937, as amended, and the Subdivision of Agricultural Land Act, 1970, as amended.

The Soil Conservation Act

The new Soil Conservation Act came into operation on 26 March 1969. During the 1971 Parliamentary Session minor amendments to facilitate the administration of the Act were passed.

Since the promulgation of the Soil Conservation Act there has been a campaign to familiarise the farming public with the Act and make them fully aware of its implications. The help of soil conservation committees, Organised Agriculture and regional advisory committees has been enlisted in programmes designed to explain the new Act and all its implications and acquaint farmers with the new requirements. Moreover, soil conservation committees, are receiving constant training mostly based on the Act for their task.

Letters and visits to persons suspected of malpractices also did much to acquaint land-users at all levels with the new Act and to make it clear that the Division has every intention of enforcing the Act.

During the past year, 2 332 suspected problem cases were brought to the attention of the Division of Soil Protection in various ways. In 2 069 of them, the persons concerned were approached either by visiting them or by letter. 393 (19,0 per cent) have not yet responded, but 1 351 (64,0 per cent) responded favourably. The remaining 325 (16 per cent) are liable to disciplinary action and personal directions can, therefore, in due course be served on them.

Experience during the past year again proved that there are very few cases in which summary disciplinary action can be taken. There is usually a time-lag between

the date when a person is warned in connection with some form of misuse of the soil or veld, to the date when there is evidence that the person is obdurate and cannot be persuaded to co-operate. The Division's policy is, therefore, rather to persuade farmers by means of correspondence and negotiation, but where there is a complete lack of co-operation the Division has no choice but to take legal action.

During the year under review 57 personal directions were served. During the same period there were also two court cases, and the accused were found guilty in both. The publicity given to the court cases is thought to have had a beneficial effect on the farming community's attitude towards the Soil Conservation Act and consequently also towards disciplinary action under the Soil Conservation Act.

Under the new Soil Conservation Act the duties of *soil conservation committees* have been considerably changed. These committees are now largely responsible for educational work, and in particular for advisory work.

Most committees have already sized up the situation in their particular areas with the prime purpose of determining the priorities in conservation work in their areas and carrying out specific educational programmes relating to those priorities. It is gratifying to note that most soil conservation committees, which in fact consist largely of committee members who served under the old system, have adapted themselves to their new duties so quickly.

The regional advisory committees all met during the past year. At the meetings conservation matters and the state of the soil under various conditions in the Regions were thrashed out. Discussion of problems was considered essential in getting the various soil conservation committees under their control to perform their function as advisory bodies and to carry out specific programmes relating to that function.

The Soil Protection Advisory Board held only one meeting during the year under review. Other meetings, and a tour that had been planned, had to be called off on account of the Department's economy drive. At the meeting, a lengthy agenda was disposed of and recommendations were submitted to the Minister.

The correct siting and construction of soil conservation works as in this photograph leads to the silting up of dongas and the re-establishment of vegetation



Farmers' works

The expenditure on subsidies and grants in respect of completed soil conservation works increased sharply in comparison with the previous year, as the following table shows:

Year	Subsidies on completed soil conservation works (R)	Grants for flood damage repaired (R)	Grants for grass ley crops in fields (R)
1967/68	1 818 946	—	10 912
1968/69	2 244 274	—	8 366
1969/70	2 852 828	—	6 688
1970/71	2 967 684	599	11 849
1971/72	*4 042 794	2 219	13 000

* This figure includes R1 019 143 for subsidies on completed soil conservation works in South West Africa, to which the Soil Conservation Act of 1969 was applied with effect from 1 April 1971

The main reasons why subsidies and grants have risen so sharply are:

Participants in the Veld Reclamation Scheme and the Stock Reduction Scheme who did not have sufficient internal camps and stock-watering points to comply with the conditions of the schemes had to plan their farms.

Interest has increased as a result of the special programmes which many soil conservation committees have launched on conservation matters such as hydrological planning of fields, fencing of eroded patches and providing enough camps to apply rotational grazing.

Most of the completed works were works aimed at controlling erosion indirectly, such as internal camp fences, stock-watering points, etc. Works for the direct control of erosion are not yet getting the attention they deserve, mainly because they are so expensive and the direct advantage to the farmer is out of proportion to the cost and the reclamation value of the works.

Major farmers' works are also receiving relatively little attention. However, there are indications that interest in the erection of major farmers' works is increasing. These works generally form an integral part of the hydrological planning of a farm, and the higher subsidy rate for the erection of such works is undoubtedly an incentive.

State works

The State works programme again showed good progress during the past year. The chief project is work in the catchment area of the Hendrik Verwoerd Dam, and progress has been satisfactory despite the Department's economy drive.

Lands on a steep slope at Umkomaas, Natal, ploughed in bank terraces and on the contour to prevent erosion



This experimental gabion was built too high and not keyed deeply enough into the walls on both sides. On the left centre stones have already been washed away and further erosion can follow



Progress with the building of new State works and the repair of damaged works during the past year is shown in the following table.

been investigated by the C.S.I.R. over the past few years. The investigation is continuing, but it appears that the high sodium content of these soils may be responsible

Year	New Works				Repair of damaged works			
	Under construction		Completed		Under repair		Completed	
	Number	Value (R)	Number	Value (R)	Number	Value (R)	Number	Value (R)
1970/71	8	285 497	5	419 120	4	129 000	6	194 269
1971/72	9	388 191	9	501 071	2	47 300	9	115 979

Despite the precautions taken in building earth banks in State works, there are still cases of banks being breached by floods, even minor ones. This problem has been investigated by the C.S.I.R. over the past few years. The investigation is continuing, but it appears that the high sodium content of these soils may be responsible for tunnel formation. Mixing gypsum with the earth seems promising, but a chemical analysis is needed every time to determine how much gypsum should be used.

Lands are often ploughed too close to rivers and streams, and the natural protective vegetation removed in consequence. The arrows show the place where sugarcane stood before the river came down



The present procedure for subcatchment planning, which is now resulting in the construction of State works, has great advantages from the point of view of both the organisation of the construction programme for State works and the stabilisation of the water courses. Since such works are now concentrated in a particular subcatchment, all designs and construction processes can be tackled better.

Soil conservation research

For the most part, soil conservation research is still done at Aliwal North. This work has not yet been extended farther than the badly eroded areas of the Upper Orange River catchment, which was specially selected for that purpose. At present four registered research projects and 17 pilot trials are in progress in that area and the work is aimed chiefly at reclaiming and stabilising dongas and other badly eroded patches or areas.

The following conclusions can be drawn from the results obtained so far in connection with the stabilisation of vegetation in dongas:

- All trees should be removed from watercourses.
- Old and superfluous vegetation should be removed regularly by slashing or chopping it down rather than letting stock graze on it.
- Areas with sediment deposits become compacted and should be loosened to a depth of about 60 cm from time to time.
- A notable improvement in the vegetation on bare and eroded parts was achieved merely by covering these areas with a layer of reeds.

- Loosening bare patches undoubtedly promotes plant growth, particularly if this is done with an ordinary plough or a checkerboard ripper.
- The planting of Spanish reed using rooted suckers is easier than planting rootstocks, although rootstocks were more successful, since conditions for planting rooted suckers, such as depth of moisture in the sediment, time of the year, etc., are very important.
- Ordinary reeds grow very well, and
- The loss of newly planted material as a result of floods is not a serious problem.

The latest findings on the deposition of sediment and sediment slopes above 33 State works that have been studied for the past 20 years, prove beyond doubt that it is necessary to establish and stabilise vegetation above these works and control the grazing of such vegetation.

The work of the research team at Aliwal North is arousing more and more interest among agricultural officers as well as members of the public. Visits by individuals and organised groups are still increasing and should be encouraged because such visits help to make farmers realise that aftercare is important when it comes to major, expensive works for the control of erosion.

Progress with soil conservation

Physical planning

During the past year the number of farms on which new physical planning was carried out rose from 2 678 to 3 605. There was also a sharp rise in the

number of farms on which supplementary planning or replanning was done: from 4 322 to 5 818. The reasons for this upsurge were:

- The keen interest aroused by the Stock Reduction Scheme, which meant that many of the farms that did not yet have adequate physical facilities to satisfy the requirements of the Scheme had to be planned.
- The fact that South West Africa was included under the Soil Conservation Act of 1969, as amended, with effect from 1 April 1971 and additional planning, therefore, had to be carried out.

The inclusion of South West Africa under the Soil Conservation Act is the main reason for the increase in physical planning. This is also reflected by the subsidy expenditure of R1 019 143 on soil conservation works in South West Africa, as against R3 023 651 on works for the rest of the Republic during the year under review.

Veld-burning

Unfortunately veld-burning is still an established practice in the sourveld areas. Untimely veld-burning, particularly in autumn, followed by constant grazing is one of the main reasons why pastures in some of the sourveld areas are in such a shocking condition.

However, as far as veld-burning in general goes, there has been a gradual change to utilisation and management of the veld without resorting to this practice. The use of appetite stimulants or supplementary feeding is becoming accepted.

In some of the extension areas where burning is still practised the extension programme are based on the utilisation and management of grazing after burning. It appears that the Department's sustained propaganda against untimely burning of the veld is starting to have an effect.

The amended Forest Act should help to safeguard the veld of conservation-minded farmers against burning as a result of fires on neighbouring farms. Under the amended Forest Act owners and occupiers of land must now take precautionary measures to prevent fires that break out on their land from spreading to adjacent veld.

Recovery of the veld

Veld improvement through the propagation of recognised management practices has for years been given priority in the Department's research and extension programmes.

Nonetheless, relatively few farmers realise the importance of giving the veld a chance to rest and renew itself. Stocking rates are still commonly based on the condition of the veld during a single, exceptionally good season. Because the carrying capacity is usually over-estimated, it is almost impossible to rest the veld.

Veld deterioration is continuing unabated and the effects of droughts have become worse and worse over the past decade. Consequently the Veld Reclamation Scheme was instituted for the cattle grazing areas after an exceptionally severe drought in 1966. The Stock Reduction Scheme for the drier sheep areas was instituted in 1969.

The purpose of both Schemes is to bring greater stability to farming in those areas that are subject to protracted droughts, by stabilising the pastures.

The Veld Reclamation Scheme

The Veld Reclamation Scheme came into operation on 1 September 1966. Applications for admission to the Scheme were accepted up to 31 August 1971. Particulars of the Veld Reclamation Scheme over the period of participation (1 September 1966 to 31 May 1973) are given in the following table:

Area	Number of participants	Area of farms entered (ha)	Area of camps withdrawn (ha)	Total amount paid out in grants (R)
Transvaal	1 845	3 566 330	1 063 895	1 900 342
Karoo	529	4 439 381	1 003 948	547 067
Free State	354	1 672 389	456 951	374 309
Eastern Cape	54	71 441	18 999	57 586
Total	2 782	9 749 541	2 543 829	2 879 304

The table shows that the total expenditure on the Veld Reclamation Scheme was R2 879 304. According to reports received from the areas where the Scheme is in operation, it has not come up to expectations. The following are some of the reasons for these disappointing results:

- Erratic and low rainfall for the duration of the Scheme.
- Too high a stocking rate on those parts of the farms not entered for the Scheme and over-utilisation of the camps that had been rested.
- Too long a resting period required — two growing seasons, including the winter between.

As participation in the Scheme increased, it became clear that unless the subclimax and pioneer grasses, which dominate the veld after resting for the entire growing season, are grazed during the following winter a large percentage of the grasses die from lack of light.

Grazing during the winter is, therefore, essential to reduce the effect of overshadowing once the grass is well-grown. Veld that has rested for a whole growing season should also be lightly grazed during the winter so that the animals can loosen the soil and so provide a suitable seedbed.

As against the somewhat disappointing direct results, there are the very encouraging indirect results of the Scheme, the chief of which is the farming community's change in attitude towards resting of the veld. There is clear evidence that:

- Attitudes of farmers towards effective veld utilisation practices have never been better than they are at present.
- There is a general awareness of the importance of sound veld control systems, since almost every extension area has a programme or a study group where the emphasis falls on the betterment and judicious utilisation of grazing.

The Veld Reclamation Scheme has, therefore, succeeded, even if indirectly; and the Department will make unremitting efforts to take advantage of this change in attitude.

The Stock Reduction Scheme

The Stock Reduction Scheme was instituted on 1 October 1969 to effect a systematic reduction in the number of stock in the extensive sheep grazing areas, because the prolonged droughts, together with declining wool prices, were resulting in ruinous overstocking of the veld on many farms.

The assistance granted under this Scheme was meant to improve the veld cover over a long period and so make the farmers less vulnerable to drought. The Scheme was modified from time to time to make it more acceptable to prospective participants, as well as to ensure that it would more readily achieve its purpose.

When the Stock Reduction Scheme was instituted in 1969 it was estimated that, on the basis of long-term carrying capacity, there were about 15 million small stock units in the extensive sheep grazing areas and about 3 million small stock too many in these areas. In order to withdraw the estimated excess of 3 million

small stock without causing chaos in the meat industry, it was decided to invite applications over a period of five years, i.e. up to 30 September 1974.

However, this Scheme was very well publicised by the Extension Service of the Department of Agricultural Technical Services over a period of more than two years, and the total number of applicants rose from 200 (December 1969) to 5 860 (October 1971). This exceeded all expectations; the number of small stock units which were withdrawn and for which compensation was paid, together with those that will be withdrawn within the next year by applicants already on record, is about 5 million. The original target of 3 million will be greatly exceeded.

The original aim of this Scheme has, therefore, largely been achieved, and since weather conditions improved it was felt that the time had come for State assistance in this connection to be reviewed.

Consequently the Minister of Agriculture announced on 2 December 1971 that —

- After 17 December 1971 the Department would not consider any new applications for complete withdrawal of stock or withdrawal of more than a third of the estimated stock numbers.
- New applications for participation in the Scheme with reduction of one-third of the calculated stock numbers would be received only up to 1 March 1972.

On 15 February 1972 the Minister changed the closing date for new applications from 31 March 1972 to 29 February 1972. This meant that under the conditions of the Scheme new applicants would have another period of 12 months after 17 December 1971 and 29 February 1972 to reduce the prescribed number of stock and so officially join the Scheme.

The decision to close the Scheme earlier than was originally planned made no difference to the position of those already participating.

The position is that everyone who has applied to join the Scheme and received the Department's permission to participate, and then reduced his stock to the calculated stock numbers within 12 months and complied strictly with the conditions of the Scheme, qualifies to participate in the Scheme for five years. During this period the participant receives compensation at a fixed rate every six months for the number of stock he has withdrawn as calculated.

The following tables give further particulars with regard to the Stock Reduction Scheme.

Because no further applications are being accepted after 29 February 1972, the data on participation are final.

TABLE 1 — Applications approved (final)

Region	Number of participants	Area entirely and partly withdrawn (ha)
Karoo	3 481	15 398 027
Free State	1 899	4 697 042
Eastern Cape	1 240	1 559 817
South West Africa	546	4 857 897
Winter Rainfall Region	482	2 350 759
Total	7 648	28 863 542

According to Table 1 about 46 per cent of the total number of participants are in the Karoo Region, farms in that region constituting 54 per cent of the total area involved in the Scheme.

TABLE 2 — Participants in the Scheme who withdrew only a third of their stock as against participants who withdrew all their stock

Region	Stock reduction only		Withdrawal of all stock	
	No. of participants	Area (ha)	No. of participants	Area (ha)
Karoo	3 148	14 767 782	333	630 245
Free State	1 704	4 472 773	195	224 269
Eastern Cape	1 045	1 412 145	195	147 672
South West Africa	546	4 857 897	—	—
Winter Rainfall Region	378	2 013 649	104	337 110
Total	6 821	27 524 246	827	1 339 296

According to the data in Tables 1 and 2, 827 participants (11 per cent) out of a grand total of 7 648 withdrew their entire farms from grazing. Of this number, 333 (40 per cent) are in the Karoo Region, 23 per cent in both the Free State and the Eastern Cape Regions and 14 per cent in the Winter Rainfall Region. There were no cases of withdrawal of entire farms from grazing in the South West Africa Region.

TABLE 3 — Expenditure on the Stock Reduction Scheme up to the end of the 1971/72 financial year

Year	Totals in all areas where the Scheme applies (including South West Africa)
1970/71	R 611 853,00
1971/72	R8 228 402,00
Total	R8 840 255,00

The amount of R8 255,00 already spent on the Stock Reduction Scheme will increase considerably. The last participants who joined will finish five years after 28 February 1973.

Whereas the results of the Veld Reclamation Scheme were somewhat disappointing, the effect of the Stock Reduction Scheme has been far more favourable. It is obvious that the withdrawal of about five million head of small stock must have a very good effect on the condition of the natural grazing in the areas where the Scheme applies. One of the most effective measures against veld deterioration is the reduction of the grazing pressure and the judicious grazing of the veld, as prescribed under the Stock Reduction Scheme.

Although it would be unwise to draw any definite conclusions at this stage, it is known that —

- On the whole, the veld of participants in this Scheme is far better than the veld of non-participants.
- The total quantity of grass and shrubs has increased a great deal.
- Valuable perennial grass species and palatable and nutritious shrubs and bushes have been far more in evidence — even in places where they have not been seen for many years.
- Farmers in general are far more veld-conscious (especially with regard to carrying capacity) than they have ever been in the past.

Veld evaluation programmes are used to ascertain the actual improvement in the veld as a result of the Stock Reduction Scheme in the various areas where the Scheme applies. However, these programmes are geared to the period of participation, which is five years, with the result that the actual effects of the Scheme with regard to veld improvement will only be known at a later stage.

The branch of a thorn tree can play an important role in the process of re-establishing totally denuded veld



Protection of fields

Mechanical protection

As regards contoured fields, cultural practices still leave much to be desired. The result is that terracing has become so common in the older fields that it is creating more problems than the contour system has advantages. And it is also true that the maintenance of contour banks is greatly neglected in many cases. However, the heavy precipitations of the past season have emphasised the importance of the matter.

For years it was impossible to make much progress with the construction of waterways, but considerable success has been achieved during the past year. For example, only 157 waterways were completed in the Highveld Region during the preceding five years, but 151 waterways were built during the past year. In the Transvaal Region 760 km of stormwater channels, waterways and contours were surveyed and satisfactory progress is being made in the Free State and Winter Rainfall Regions. This breakthrough is due chiefly to the increased and extension recently given to the hydrological planning of areas, and extension programmes have also been introduced in many of the areas to speed up the effort.

However, problems are still being experienced with hydrological planning where communal waterways have to be planned on farms. Farmers do not always want to co-operate and the entire plan then fails. This stumbling-block has now been removed — unco-operative farmers can now be forced to co-operate in terms of section 4 of the Soil Conservation Act of 1969.

During the year under review several fields were withdrawn from grazing and cultivation after personal directions. The serving of these directions helped a great deal to make farmers take the mechanical protection of fields seriously.

Considerable losses of soil as a result of wind erosion were again reported. However, most of the farmers in the affected areas are now wind-erosion conscious. They are having fair success in controlling wind erosion by using the right implements and by cultivating the soil only when it is wet.

The biological protection of fields

The cultivation of restorative crops is not yet generally accepted. However, it is encouraging to note that grants under the grass by crop recovery scheme for fields increased to R13 000 this year, as against R11 849 the previous year. Considering the extent and the importance of the Republic's croplands, this expenditure is insignificant.

Malpractices such as continual cropping and the removal of crop residues by grazing and, in some cases, by burning are still common. On the other hand, there are more farmers every year who prevent erosion by not removing crop residues and by growing perennial pasture crops.

Soil conservation competitions and farmers' days

The various soil conservation competitions and farmers' days were again very well supported. This indirect extension method, where farmers on whose

Serrated tussock grass *Nasella trichotoma*, the useless invader which has become a menace to grazing in parts of the Eastern Cape Region



A stretch of land in the Molopo area a year after it was cleared of bush and established with *Anthephora pubescens* grass



farms the conservation days are held can describe their successes to other farmers, helps a great deal to get farmers to accept conservation practices.

In the Eastern Cape Region 12 farmers' days on soil conservation were held and attended by 515 interested farmers, and in the Free State Region, 14 soil conservation competitions were held in which 191 farmers took part.

In South West Africa two master conservation farmers were chosen during the past year.

Catchments

State acquisition of land in catchments

Three properties with a total area of 3 529 ha were acquired by the State during the year under review and placed under the control of the Department of Forestry. These properties are all situated in the Winter Rainfall Region.

Catchment planning

Despite a serious shortage of staff good progress is being made with catchment planning. Physical planning is already far advanced in some subcatchments and has

been completed at the Nuwejaarspruit (Free State Region), Broekspruit (Karoo Region), Bossieslaagte (Eastern Cape Region) and Opkoms (Highveld Region) subcatchments.

The subcatchments that constitute the catchment area of the H.F. Verwoerd Dam are being given top priority at present, and progress is satisfactory.

Urgent attention is also being given to the following subcatchments situated outside the Upper Orange Catchment:

- Lindley-Reitz area (Highveld).
- Upper Gonubie and Kat River subcatchments (Eastern Cape Region).
- Nuweplaas subcatchment in the Langkloof (Winter Rainfall Region).

Progress in this field is being severely hampered by a lack of trained staff.

Driftsand control

Area involved — The estimated area subject to active wind erosion is about 923 640 hectares, 895 000 hectares being situated on the west and south coasts, and about 28 640 hectares on the east coast.

Measures taken — Coastal drift-sands are controlled by the Department of Forestry.

The stabilisation of active drift-sand is a long process and progress is very slow. Some of the measures taken in an attempt to control active wind erosion in coastal areas are the covering of sand-dunes, strip-cropping, fencing off into camps, withdrawing areas from grazing and cultivation and planting trees as windbreaks wherever feasible. The cost, however, is very high.



Satansbos, or silver leaf bitter apple, *Solanum elaeagnifolium* came to South West Africa in lucerne, became established in various places and started to spread. Fortunately it has now been totally eradicated

SOIL FERTILITY

Soil fertility studies

Phosphate trials carried out in co-operation with the University of the Orange Free State show that the phosphate status of the soil at **Vaalharts** varies to such an extent from place to place that no general standard recommendation can be made for that area. The only basis for recommendations is soil analysis for every field.

The phosphate in the subsoil is virtually exhausted and the potassium content of the soil is critical in only a few cases.

A project concerning the phosphate status of the soils at **Vaalharts** was completed during the year under review. It was established that the continued high applications of phosphate has already caused a high phosphate status to build up in the soils. Several of the soils tested already exceeded the norm for "high" content. Apart from the newly cultivated soils only one soil tested fell into the "low" category.

All the subsoils contain exceptionally low quantities of available phosphate. The extractant that showed the most satisfactory correlation with plant intake sodium bicarbonate (Olsen extractant).

In the course of a project on growth arrestment disease in sultanas growing along the **Lower Orange River** 510 plant samples taken in November were analysed. It was again apparent that samples with a low potassium:magnesium ratio all proved to be diseased.

A project on the zinc status of the **Vaalharts** soils showed that these sandy soils are generally well supplied with available zinc. However, there are great variations from place to place and even within trial blocks. These subsoils are almost all very deficient in available zinc.

A cultivation trial with sultanas along the **Lower Orange River**, which has been in progress since 1968, again showed that deep tillage practices are an effective way of combating growth arrestment disease and raising production. The crops obtained with deep tillage practices were up to 50 per cent more than those grown under ordinary shallow tillage.

The potassium status of soils at **Vaalharts** and **Upington** was investigated by means of pot trials in an attempt to solve the *Verticillium* wilt problem in cotton.

It was established that soil of the **Mangano** series containing 10 per cent of clay should have a potassium content of 150 p.p.m., extractable by ammonium acetate, for maximum potassium absorption by cotton.

If the soil of a **Mangano** series is acidified until the pH value is 4.7, both clover and cotton absorb toxic quantities of manganese. Heavy applications of ammonium sulphate to cotton at **Vaalharts** could possibly cause the pH value of the soil to drop so low at the beginning of the season that manganese toxicity occurs. However, the pH increases gradually after each irrigation, as a result of the alkalinity of the irrigation water, until it returns to normal towards the end of the season.

Fertilising soils where *verticillium* wilt is known to occur with ammonium sulphate, zinc sulphate and superphosphate resulted in normal quantities of plant-food elements in cotton leaves, except in cases where the potassium content was low. Increased sulphur and potassium absorption was obtained with applications of iron sulphate, potassium sulphate and gypsum. Although the potassium absorption was more noticeable, the increase in sulphur absorption is also important. No connection between manganese toxicity and *verticillium* wilt has been established.

From the point of view of nutrition this trial is yet another indication of the connection between *verticillium* wilt and low potassium values in the soil.

In a second trial in the course of which the *verticillium* wilt problem was investigated, affected cotton plants were transferred to pots, soil and all, and placed in a glasshouse. After the plants had been cut back, various treatments were applied.

No treatment using either micronutrients or macronutrients removed the symptoms of *verticillium* wilt, even after the plants had been cut back again and the treatments repeated. The reason for this may be fixation of these elements.

In the course of a trial at **Sand-Vet** it was established that compaction of the surface of the soil of the **Shorrocks** series following flood irrigation is the chief cause of the drop in wheat yields. Both a synthetic substance for improving the surface structure and molasses meal applied at 20 tons per hectare improved the surface structure so much that only nine irrigations produced a wheat crop of 5 640 kg per ha as against the 4 750 kg per ha produced by the control.

Sprinkler irrigation of soils of the **Vaalharts-Mangano** series would keep the surface structure in a better condition than flood irrigation, according to preliminary results.

It was found that deep or shallow ploughing did not affect yield. This may be due to the fact that deep-ploughed soil very quickly becomes compacted again after flood irrigation.

The manure and straw trial and the soil cultivation trial at the Langgewens Experimental Farm have a bearing on the study of soil fertility. Both trials have been in progress for more than 30 years; a system of alternating wheat, old land and fallow is used. The unprecedented drought at Langgewens reduced the yields a great deal so that no conclusions about the possible effect of rotational cropping could be drawn.

In the manure and straw trial the differences between the treatments were very slight. In the cultivation trial the treatments where fallow was eliminated did best. These results are contrary to what may be expected in normal years, but confirm findings in previous dry years.

The cation exchange capacity of a soil determines the quantity of reserve nutrients the soil can retain. When heavy fertilisation is practised a high cation exchange capacity is a very big advantage in that nutrient imbalances do not easily occur.

The total cation exchange capacity of a number of soils from the Elgin area that were investigated dropped rapidly with depth as a result of the decrease in organic matter. The cation exchange capacity was also directly proportional to the pH of the soil and the exchange reactions were affected by the factors mentioned above.

Soil acidity is common in the orchards of the Western Cape, particularly in the subsoil where the pH can be corrected only while the soil is being prepared for planting. Aluminium toxicity, one of the results of soil acidity, is receiving a considerable amount of attention at present, since it results in the development of a poor root system and retards shoot growth.

Langfos rock phosphate is not readily available to plants and the effect of fineness on availability was investigated. It was found that fineness had no effect on availability to maize or apples (Golden Delicious M793) during the first season after application, but that the application of water-soluble phosphate together with the rock phosphate suppressed the availability of the rock phosphate.

Yields of up to 12 400 kg of grain per hectare (117 bags per morgen) have been obtained this season on experimental plots at the Tabamhlope Experimental Station on the Farningham series in Natal. Without fertilisation and liming this soil yielded an annual average of less than 1 000 kg per hectare over the past fifteen years.

Intensive research indicated that small but toxic amounts of aluminium and a very high phosphate fixing capacity were characteristic of many acid soils of the Highland Sourveld at a rainfall of 850 mm per annum or higher. The soil was limed to a depth of 75 cm and in

addition to adequate amounts of nitrogen, potash and trace elements (up to 12 tons of single superphosphate per hectare) were applied as a broadcast dressing. The object of deep liming was to eliminate active aluminium and thus encourage deeper rooting into the subsoil.

At a plant population density of 50 000 per ha, yields of 10 200, 11 300, 11 600 and 12 400 kg per ha were obtained when 1½, 3, 6 and 12 ton of superphosphate per ha were applied respectively. On one plot the soil was completely inverted to a depth of 75 cm, bringing up the subsoil. This plot gave the surprisingly high yield of 92 bags per morgen.

The effect of the lime application may possibly persist for up to 15 years if supplementary light surface applications are given occasionally. The residual effect of the highest phosphate application is expected to last for a period of at least eight years if normal applications are given in the row at planting in addition.

It is remarkable that the cost of the fertiliser which includes 12 tons of superphosphate, approximately ¼ ton of urea, ¼ ton of muriate of potash, a trace element mixture and 8 tons of lime per ha was recovered within the first season.

At present these results can be applied only to certain deep, well-drained soil series of the Highland Sourveld. In spite of their very low natural fertility they are nevertheless potentially highly productive when correctly treated.

Fertilising practices

Where sufficient irrigation water is available, a permanent cover crop is generally grown with apples and pears in the Winter Rainfall Region because it helps in preventing compaction in soils. Fertilisers have to be applied on the surface in such cases and pot trials were undertaken using radioactive phosphate and calcium to determine what part cover crops play in the movement of fertiliser.

Phosphate applied to heavy Hutton and Clovelly soils in the form of superphosphate was readily absorbed by a rye grass cover crop and distributed in the deeper roots. With calcium, however, virtually no downward movement in the roots was found; this is of great importance to the control of soil acidity and the secondary problems caused by it.

Urban compost — During the past season the fruit and table grape industries of the Western Cape again experienced a shortage of organic fertiliser. The shortage was partly relieved when the collective production of 20 000 tons of urban compost from four plants in the Western Cape was sold almost wholly to the agricultural sector.

It was found that:

For all practical purposes urban compost may be regarded as an organic fertiliser with a constant physical and chemical composition.

There is no difference between winter and summer compost.

Urban compost is primarily a preparation with a high organic content for improving the soil. Its value as a fertiliser is more or less the same as that of kraal compost and it contains considerable quantities of trace elements.

Applications to the soil surface of up to 300 tons of fresh compost per ha in the form of a topdressing, and up to 600 tons per ha worked in deep during the preparation of the soil produced no toxic effects.

Producers in the Highveld Region follow widely differing fertilising programmes. Apparently too little fertiliser is applied, particularly in the case of potassium. In the North-Eastern Free State symptoms of potassium deficiency are found on maize and wheat.

The practice of broadcasting and ploughing in raw phosphates during winter and band placing mixtures at planting is being applied by more and more producers.

Although agricultural lime is not yet being used as much as it should be, the use of lime is increasing on the more acid soils.

It is encouraging to note that farmers in the Transvaal Region are tending to follow the fertilising practices suggested by agriculturists and based on soil analyses.

The South-Eastern Free State Subregion has few fields with a high production potential. The available fields are used chiefly for the production of feed and few farmers fertilise on the basis of the findings of soil analyses. The same problem is experienced in the Gordonia and Bechuanaland Subregions.

Good fertilising practices are gaining ground in the Central Free State Subregion, although most of the farmers there do not fertilise on the basis of soil potential and soil analyses.

The consumption of fertiliser is rising annually at Vaalharts and the new fertiliser mixture 4:1:1(30) has done a great deal to simplify fertilising on irrigation farms. Fertilising practices have improved enormously over the past few years because of the good results obtained everywhere in co-operative fertilising trials.

Co-operative phosphate and potash trials with potatoes on three farms in the Douglas district did not

produce higher yields during the past two years. High potash levels even had a depressing effect. It appears that the phosphate level of some soils has been built up to such an extent that they could produce without fertilising for one season.

The general trend appears to be that farmers in the Natal Region are applying larger quantities of fertiliser to their cultivated pastures.

To test the validity of experimental findings a 10 hectare field was planted to maize N, P, K and lime were applied in the quantities shown to be necessary by the experiment. Notwithstanding a serious drought in late January yields in excess of 7 000 kg per ha were obtained.

This demonstration field aroused much interest and the results have confirmed experimental findings on a field scale.

The soil testing service at Cedara continues to grow in popularity. In 1968 a total of 790 soil samples were analysed, but during 1971 this number increased to 4 081.

The training courses offered to farmers in the Fish, Sundays River and Smartt Syndicate irrigation areas, and the establishment and development of the Cradock experimental plot near Cradock have done a great deal to stimulate interest in improved fertilising practices in the Karoo Region. In a few cases field crop production rose considerably. This may be ascribed directly to the training courses.

Although the use of fertiliser is increasing in South West Africa, farmers still do not know enough about fertilisers. Moreover, unpredictable rainfall often discourages the use of fertiliser and a number of farmers use no fertiliser or only kraal manure.

Mineral deficiencies

Zinc deficiency symptoms are common throughout the Highveld Region. However, the problem is being effectively controlled by applications of zinc, either as the sole fertiliser or in mixtures containing zinc.

Molybdenum deficiency is commonly found in very acid soils. However, the problem is effectively controlled by treating the seed with molybdenum compounds.

The investigation of trace element imbalances used to be a study of deficiencies. Recent investigations have revealed that there are certain soils in the Winter Rainfall Region that are exceptionally rich in extractable boron or manganese. It is possible that these values exceed the tolerance of certain crops and cause crop losses.

High boron values were determined in subsoils of the Mkambati, Swartland, Muden, Mispah and Lindley series and high manganese values in topsoils of the Kanonkop and Msinga series.

The investigation is continuing.

Dryland lucerne in the Estcourt area of Natal responded to molybdenum on a soil of the Avalon series.

Work conducted at Dundee has demonstrated a 90 per cent yield response in wheat following the application of boron. This work is being followed up and is likely to have a considerable impact on dryland wheat production in Northern Natal.

The element in which almost all soils in the Free State Region are deficient is zinc. In the Gordonia Subregion leaf analyses, carried out in places where growth arrestment disease occurs, revealed a low boron content. Boron deficiency also occurred in the Bechuanaland Subregion this year.

On the Sand-Vet irrigation plots applications of molybdenum to heavy soil boosted lucerne production. According to observations boron and sulphur deficiencies are also present. Applications of sulphur to groundnuts under irrigation produced improved leaf growth and increased nut production.

In the Griqualand West Subregion there was severe yellowing in orchards on lime-rich soils as a result of lime chlorosis. Farmers sprayed the vineyards with iron chelate or ordinary ferrous sulphate solution and results were promising.

Owing to the high pH of the alkaline brack soils of the Hardap irrigation scheme in South West Africa some of the micro-elements are being fixed. There are indications that in places boron occurs in toxic quantities in the soil. The high alkalinity of most Karroid soils means that induced zinc and iron deficiencies are found, particularly in fruit trees and crops like onions. It was found that leaf spraying is effective in curing these deficiencies.

The use of agricultural gypsum to improve the alkalinity of soils is becoming increasingly popular among farmers.

The first 42 leaf samples from apricot trees in the Fish River Valley were collected and analysed in order to establish standards for recommending fertilisers. These preliminary analyses indicate a severe nitrogen deficiency. The elements zinc, manganese and iron also occur in insufficient quantities. Production can be greatly stimulated if these deficiencies are supplemented by leaf spraying or fertilising.

Use of fertilisers

Fertiliser is being used in increasing quantities in the Highveld Region. This appears to be the result of more judicious and more effective fertilising, based on the production potential of soils, and of the excellent results obtained by farmers by utilising the soil in accordance with its production potential.

The use of fertiliser is increasing in the Transvaal Region and when limiting factors such as soil acidity are removed the rate of consumption should increase still further. However, the methodical use of lime still leaves a lot to be desired.

On the Sand-Vet scheme the use of nitrogen fertiliser has increased by about 50 per cent and that of phosphate fertiliser by about 30 per cent. Owing to the danger of acidification in the sandy clay loam of the Sand-Vet, limestone ammonium nitrate has virtually replaced the other nitrogenous fertilisers.

Along the Lower Orange about 2 500 tons of fertiliser is applied annually on about 25 000 morgen of irrigation land. A survey showed that fertiliser is applied mainly according to the farmer's discretion and little use is made of soil analysis.

Owing to the fact that farmers have become far more interested in growing cash crops, the use of fertiliser, especially superphosphate and ammonium sulphate, has increased still further in the Karoo Region. In some cases the mixtures 2:3:2 and 2:3:4 are also used.

The availability of agricultural gypsum in bulk and the rebate on the railage announced last year were largely responsible for a considerable increase in the use of gypsum.

It is estimated that about 3 000 tons of fertiliser was distributed in South West Africa during the past year. Mixtures such as 2:3:2(22) and 3:2:0(20) and individual fertilisers such as limestone ammonium nitrate, ammonium sulphate, urea and superphosphate are among the most important fertilisers used.

Other soil and water studies

In the Free State Region the investigation into the effect of solutions of mixed salts on the physical and physical-chemical properties of certain soil series with a view to preventing brack formation and reclaiming brack soils was completed. From the results it will be possible to predict the behaviour of soils when water containing various chemical compounds is used for irrigation.

An important finding is that the mineralogical composition of alluvial soils and soils of the Hutton

form appear to be very similar. The clay fraction consists of about 36 per cent of montmorillonite and 12 per cent of vermiculite.

When these soils are treated with potassium and allowed to dry out they lose their swelling and dispersion properties and react like soils treated with calcium or magnesium. When sodium treatment is applied the opposite takes place. In the presence of magnesium and sodium the soil strength of these soils is higher than in the presence of calcium and the same quantity of sodium.

A project on *soil strength and compaction* on fine, sandy irrigation soils showed that high soil strength values in Vaalharts soils are causing serious problems with regard to root penetration and subsequent growth. It was established that, owing to the good sorting of the sand fraction, compaction of the subsoil is a natural phenomenon. There are indications that compaction is aggravated by pressure from heavy implements, especially when cultivation takes place when the soil is too wet.

The results of pot trials showed that not only is there a direct negative relation between soil strength and root length, but that a high degree of soil strength impedes the absorption of certain plant nutrients, especially potassium, very seriously. The study proved that a high degree of soil strength does not affect the total root mass as such but that the length of the roots decreases a great deal and their thickness increases. This means that the efficiency of feeder roots is seriously impeded.

According to the final report on the soils of the Central Orange basin the alkaline clay soils cannot be efficiently and economically utilised for development under irrigation under the Orange River Scheme. The only soils recommended for irrigation are the soils of the Hutton and Clovelly forms. There are large enough areas of these soils to utilise the available supply of water from the Orange Scheme.

Soil surveys are at present being carried out on a large number of farms in the various farming areas of the Upper Berg River in the Winter Rainfall Region in connection with a study of natural resources and practices. Forty farms have been mapped in detail since the beginning of 1972. A large number of samples of typical soil profiles was analysed for macro-elements, exchangeable cation, particle-size distribution and moisture constants.

The installation of *asphalt barriers* on sandy soils may one day become common practice on South African farms. This extraordinary treatment increased cane yields by 40 ton per hectare in 14 months in an experiment conducted at Tongaat in Natal on a soil of the Fernwood series containing only 6 per cent clay. The

yield increased from a four plot average of 67 tons of cane per hectare (4,1 tons of sucrose per hectare) to 107 tons of cane per hectare (6,1 tons of sucrose per hectare) as a result of laying an asphalt barrier 60 cm (24 inches) below the surface of the soil.

This treatment retards the downward movement of soil moisture and the leaching of soluble nutrients by water percolating through the soil to depths beyond the root zone of crops.

Over the past four seasons the field in which this experiment was situated yielded an average of only 44 tons of cane per hectare at 19 months giving a production of 2,3 tons of cane per hectare per month, whereas the experimental plots with asphalt barriers produced 7,6 tons of cane per hectare per month.

These results are likely to have application over a large area of Southern Africa where rainfed crops are grown on sandy soils.

During the year under review a series classification was completed in the Highveld Region on 180 000 ha. This total area includes 150 000 ha situated in the Upper Orange catchment area. Association maps for this area and for 28 000 ha near Venterskroon are being drawn up.

There is far more interest in soil in the Karoo Region than there used to be because crop farming is expanding to an increasing extent. The number of soil samples received from farmers increased by 300 during the past year.

It was found last year that the collapse of earth banks in soil conservation works is caused by the high alkalinity of the soil. At present agricultural gypsum is used to counteract this condition. So far all the earth banks that showed a high sodium content and were treated with agricultural gypsum are still undamaged and this treatment seems to be highly successful. The analysis of soils used for building earth banks is becoming common practice and will go far to ensure that these relatively expensive structures are virtually permanent.

The soil mapping of the Broekspruit and Palmietfontein subcatchments in the Upper Orange has already been completed. Only 10 smaller subcatchments remain to be mapped. The completed surveys are already serving as a basis for detailed planning of farms and optimal land use.

The recent local design and manufacture of very small plastic sprays suitable for micro-irrigation systems was a great break-through in the field of *irrigation equipment* in the Republic of South Africa. These sprays, which are the size of the filter of a cigarette, have made the Republic one of the world's leading

contributors to irrigation technology. These sprays are especially suitable for spraying orchards and vineyards on the soil types of the Western Cape.

Controlled irrigation can very easily be applied with the aid of these sprays and soluble fertilisers can be applied to a specific surface area at each stem. A low water pressure of under one bar is all that is needed.

The investigation into the advantages of applying gypsum on the saline but slightly *brack* soils of the Breë River Valley where a lot of fresh water is used for irrigation, was continued.

It was found that the application of gypsum greatly increases the absorption of irrigation water and consequently the efficiency of irrigation. This considerably reduces crusting when the soil dries out.

It was proved that the gypsum should be applied chiefly in the irrigation water. Although the gypsum concentration can be reduced over a period, it appears that gypsum will have to be used at low concentrations for many years in order to ensure good permeability.

With a view to optimal production per unit of water, it is necessary to measure the effect of various soil moisture regimes on the photosynthesis of fruit trees. Trials under field conditions and controlled conditions showed that maximum net photosynthesis is attained between 15°C and 25°C. When the temperature rises moisture stress in the plants causes photosynthesis to drop sharply.

The Plant Protection Research Institute studied the following factors with regard to their effect on *root rot in maize*: The application of organic matter, nitrogen, saprophytes, and soil temperature and season.

Three saprophytes applied, viz *Trichoderma viride*, *Aspergillus terreus* and a *Penicillium* sp. had no effect on root rot as such. However, these saprophytes did have an evident effect on the incidence of a few groups of fungi. Similarly the application of organic matter (0.6 per cent of maize hay) had no effect on the intensity of root rot, but did affect the incidence of individual groups of fungi.

The effect of soil temperature was investigated by correlating observations of root rot with temperatures at various soil depths, and with the continuous mean temperature over a season. Few differences were found in the temperatures at the various soil depths, and the soil temperatures over the growing season did not change much.

With regard to lesion populations, it was found in one locality that at a soil depth of from 5 to 15 cm the pathogens *Helminthosporium pedicellatum* and

Fusarium spp. complement each other, i.e. when numbers of one are low those of the other are high. However, this was not found to be true of the 15 to 25 cm zone.

In a second locality it was found that *Fusarium* spp. were the dominant lesion population. *H. pedicellatum* was an active competitor at the start, but numbers began to drop sharply about half way through the season.

To sum up, one could say that the course the root rot syndrome runs during a season depends on the season as such and not on individual factors.

Soil surveys

The Soil and Irrigation Research Institute carried out the following surveys during the year under review:

Transvaal Region – The extensive mapping of 1 300 000 ha in the Messina Bushveld, 200 000 ha on the Springbok Flats, 300 000 ha between Pretoria and Pilanesberg and 1 000 000 ha in the South-Eastern Transvaal.

Intensive surveys of the experimental farms at Onderstepoort, the Animal and Dairy Science Research Institute at Irene, and the Horticultural Research Institute at Roodeplaat were also carried out. At Levubu 300 ha was intensively investigated in order to determine suitability for irrigation.

Highveld Region – Extensive mapping of 300 000 ha in the vicinity of Wesselsbron.

Natal Region – Extensive mapping of 400 000 ha in Northern Zululand.

Free State Region – Extensive mapping of 500 000 ha in the vicinity of Thaba Nchu.

Eastern Cape Region – Semi-intensive survey of the Bushman's River area – 50 000 ha was investigated to determine suitability for development under irrigation.

Winter Rainfall Region – Extensive mapping of 300 000 ha in the Breë River Valley. Intensive survey of irrigation soils along the Duivenhoks River at Heidelberg.

The *Irrigation Research Subdivision* of the Soil and Irrigation Research Institute started to function this year. The chief projects were the expansion of research facilities and urgent research concerning the development of proposed irrigation schemes.

With regard to the development of irrigation schemes, an extensive research programme on the physical properties of the soils concerned and the quality of the irrigation water was started. The first results for the Fish River soils have already been obtained. Preliminary findings indicate that irrigation water in South Africa contains relatively little matter in solution (salts) and that the addition of gypsum to the water or to the soil could help make irrigation systems more stable. The water in storage dams that is to be used for irrigation generally also has only a small quantity of salts in solution. During a trial carried out with a view to developing soils along the Great Fish River, it was found that the application of gypsum in the water of the Orange River, or to the soil, increases the permeability of those soils to water and consequently their irrigability.

It is essential that more attention should be given to irrigation and drainage in order to keep the productivity of land that has been brought under irrigation at great expense at a high level. In co-operation with the Free State Region the Soil and Irrigation Research Institute compiled a handbook on the drainage of irrigated soils. This handbook may be obtained free of charge from the Government Printer.

The Subdivision of Planning of the Soil and Irrigation Research Institute has already completed the following tasks:

Soil and irrigation maps were compiled for the following parts of the Orange River project for the supply of water from the P.K. le Roux Dam:

On the southern bank as far as Hopetown and on the northern side up to the farm Ramah, as well as the Lückhoff-Koffiefontein area.

In order to evaluate the possibilities of the proposed expansion of the Levubu irrigation scheme more accurately, it was necessary to carry out a soil survey on about 310 ha on the spot.

A pilot development project was planned on the Makatini Flats to make it possible to —

Do research on large-scale farming systems and irrigation practices for future application, undertake trials with regard to the reclamation of brack soils, and determine the optimal size of plots for the irrigation area.

Irrigation schemes at Hardap (Mariental, S.W.A.) and Koppies (O.F.S.), the Gariep settlement on the Orange River and the Great Fish River irrigation area (Knutsford up to Middleton C.P.) were investigated with a view to replanning.

Veld management

Various factors such as the effect of the drought during the sixties, the results of the Stock Reduction Scheme, in terms of which about 5 million hectares of land have now been withdrawn from grazing, and disciplinary action under the Soil Conservation Act, have helped to stimulate interest in veld management. There are widespread signs that farmers are becoming increasingly aware of the value of lighter grazing and of resting the veld.

Efficient utilisation of the veld is prevented mainly by the fact that farmers overestimate the carrying capacity, and have an inadequate understanding of the basic principles of sound veld control and inadequate facilities such as insufficient internal camps and watering points.

For the second successive year weather conditions were very favourable over virtually the entire **Eastern Cape Region**. The existing livestock population could not utilise the luxuriant growth of the grass in all areas, with the result that an exceptionally large amount of veld was rested. Unfortunately this prompted untimely burning of the veld in certain districts. It is remarkable that cattle numbers are increasing in relation to sheep numbers.

Where the Stock Reduction Scheme is in force, the veld recovered most satisfactorily in general; the recovery of red grass was particularly striking. Even where the veld had been very denuded, the pioneer grass cover recovered readily. The application of orderly systems of utilisation still leaves much to be desired, but farmers throughout the country are coming to realise that the veld should not be severely defoliated.

Despite the exceptionally good rains towards the end of summer the growth of the short sweet grassveld of the northern parts of the Eastern Cape was disappointing. The recovery of plants after defoliation was slow and the composition, cover and vigour of the vegetation were poor.

Research on the value for grazing of the edible bush in the valley bushveld was continued. Results indicate that, although the protein content of this pasture is probably adequate for stock production throughout the year, a shortage of energy owing to the low digestibility of the available pasture could be a serious problem.

Owing to inefficient management optimal use is not made of the natural pastures, particularly in the high rainfall area of **Natal**. However, there has been an



The Namib Desert in a dry year



The same part of the Namib after good rains

encouraging swing and a considerable number of farmers are at present trying out advanced grazing systems in that area.

The favourable climatic conditions of the past two seasons have helped a great deal to stop the deterioration of the veld.

In the moist tall grassveld of Natal veld which had been reinforced with star grass *Cynodon plectostachyus* and heavily fertilized with nitrogen produced up to 10 tons of dry matter per ha compared with about 1 ton per ha from unfertilized veld. The star grass took over completely from the indigenous grasses at high levels of nitrogen, forming a dense, nutritious pasture.

At Estcourt it was found that veld that had been cut every summer for hay for 36 years produced less than 50 per cent as much dry matter as veld that had only been cleaned off with a mower at the beginning of each season. Obviously hay camps should be rotated with grazing camps to avoid reducing the productivity of the soil through continuous removal of nutrients.

Burning the veld after the first spring rains reduced subsequent yields by more than 50 per cent compared with mowing in August to remove unwanted material. Veld burning should be reduced to the minimum necessary for good management.

Research carried out at the Noyjons Experimental Farm and the Zwarttrand Research Station of the **Highveld Region** indicates that the stocking rate is one of the most important factors in veld control. No system of veld control will succeed if too many animals are run per hectare. On the other hand, a fairly poor system can be applied successfully if the carrying capacity is not exceeded and the veld is divided into veld units in advance.

Only a fairly small percentage of the grazing in the region was divided on the basis of veld types and consequently selective grazing is the general rule.

The natural grazing in the **Transvaal Region** is in a very poor condition in general. Owing to incorrect utilisation practices the composition of the veld in both the bushveld and sour grassveld areas has deteriorated greatly over the years. The widespread rains, followed by more rain, during the past growing season greatly stimulated the growth of the natural pastures.

The most usual utilisation practices in the sourveld parts are to keep the pastures short during summer for a number of years and then rest them for a full growing season. Where vegetable matter accumulates to any great extent it is removed early in spring by burning. Burning with the object of providing green pastures during the autumn and winter months still occurs in the Eastern and South-Eastern Transvaal Subregions.

Because the veld is cropped so short and is, in fact, grazed continuously many of the better and more palatable species have already disappeared from the veld composition.

The grazing potential has dropped sharply over the years in the Bushveld as well. Drought is not solely responsible for this; the utilisation practices generally followed are harmful to the veld over a long period. The perennial and more palatable species are utilised excessively with the result that in most sweet bushveld areas the grasses are chiefly annuals and pioneer species.

The present cover and species composition in the Bushveld fall far short of the inherent potential of the area. Nevertheless the present carrying capacity is still estimated at the same level as two decades ago. On farms in the Bushveld, including farms already planned, there are generally far too few camps.

Fortunately the enthusiasm of farmers in the Transvaal Region for utilising their grazing correctly is increasing all the time — they are becoming more and more grazing-conscious. The two most important species of grass in this Region are buffalo grass *Cenchrus ciliaris* and weeping love-grass *Eragrostis curvula*. In the warmer parts of the Bushveld buffalo grass is rapidly gaining ground. This grass is very popular with farmers, either on dryland or under irrigation. The yield potential of this artificial pasture is very encouraging in the semi-arid parts and may in future help a great deal to ensure that the natural pastures are utilised correctly and more systematically.

In the colder, high-rainfall parts of this Region weeping love grass remains the most important artificial pasture on dryland. This species is particularly popular in the South-Eastern Transvaal, where it is used chiefly for wintering animals.

In a trial at the Towoomba Research Station, where continuous grazing is being compared with three established seasonal rotational grazing systems, the results show that the controlled systems produce better increases in live mass than continuous grazing does.

In addition, the veld composition and cover are also better than when continuous grazing is applied. Bush encroachment is extensive under the uncontrolled treatment. In a project at the Nootgedacht Research Station the species of grasses preferred by cattle and sheep are being determined with the aid of fistulated animals and veld observations.

Preliminary results show that *Andropogon amplexans*, *Trachypogon spicatus*, *Tristachya hispida* and, to a certain extent, *Themeda triandra*, *Brachiaria serrata* and *Eulalia villosa* are regarded as palatable

species. Apparently palatability does not depend on veld composition, since these species each constitute only about 0,1 to 6,0 per cent of the veld composition.

At the Athole Experimental Farm facilities for the development of a viable stock farming system for sourgrassveld areas with little or no arable land, have been created. This system is based on obtaining maximum production of herbage from palatable species, combined with supplementation for the greater part of the year to compensate for the consequently lower feeding value of the herbage.

Thus far there has been a marked improvement in the vigour of the sward. Although it has not been possible to maintain stock in a satisfactory condition for twelve months on natural grazing only, it has been possible to shorten the winter feeding period considerably by carrying cows on veld into June and ewes as long as July.

Preliminary observations on the possible role of veld re-inforced by insowing with legumes in the sourveld areas, have demonstrated that such species as *Vigna vexillata* and *Lespedeza cuneata*, which are well adapted to conditions on the Eastern Highveld, have provided a palatable nutritious forage in the autumn months.

At the Messina Experimental Farm a trial is being conducted to determine the effect of goats and cattle, separately and together, on mopani veld. Observations made during the past year show that for most of the year goats do not compete directly with cattle for edible matter. It is only for a short period at the beginning of the season, when young growth is available, that there is direct competition between goats and cattle.

The increases in the masses of the animals show that the performance per animal is slightly better where goats and cattle graze together on the veld.

In the **Karoo Region** the natural pastures are virtually the only source of stock feed and the condition of the veld is by far the most important factor that affects the small stock industry.

During the past year the favourable weather conditions have brought about a considerable improvement in the veld; the most striking development was the widespread increase in grasses. At this stage, however, the grass cover can by no means be regarded as satisfactory. The present grass covers have come into seed and helped considerably to supplement the exhausted sources of seed.

The carrying capacity of the veld is greatly overestimated, which means that the veld can improve only when the rainfall is very good.

Generally speaking, feeding conditions for stock in the Karoo have not been as good for years as they are now, but the pastures are still in a very vulnerable transitional stage.

An important development in the utilisation of veld is the increased interest in cattle farming among farmers. Interest is greatest in the wetter, grassier areas in the eastern and south-eastern parts of the Karoo, and in the mountain suurpol areas. If more cattle and fewer sheep were kept the effect on the natural plant cover would certainly be beneficial. Several grazing camps on various farms where only cattle had grazed were inspected. In comparison with "sheep veld" the "cattle veld" undoubtedly has a far better grass cover.

Exceptionally favourable weather conditions with plentiful and widespread rains occurred in the **Free State Region** during the year under review, but despite the good season there were still cases where the veld showed no signs of recovery and the grass did not even grow. These areas will have to be reclaimed by reseedling the veld or by other methods.

Farmers overestimate the carrying capacity of the veld and on the whole omit to apply grazing systems. It is only by chance that the veld is ever rested during the growing season. Species selection is widespread because the resting and grazing periods are not sufficiently adapted, the separation of veld types is not adequate and the number of camps also leaves much to be desired.

In the South-Eastern Free State a small number of farmers is at present applying the three-camp system with good results, but in general the farmers are very reluctant to apply any grazing system.

The results of the Stock Reduction Scheme are encouraging in all areas, as far as the resting of the veld goes. Climax veld is now found on a number of farms and the good summer season has helped a great deal to make farmers realise that veld management is essential.

A number of trials are in progress at the Glen Agricultural Research Institute: cattle, sheep and mowing machines are used separately to defoliate the veld. It appears from preliminary conclusions that grazing during autumn is the most harmful to the veld. The individual grass species also respond differently to defoliation during various seasons.

Multiple camp rotational grazing systems applied co-operatively by cattle farmers on the Ghaap plateau show an encouraging improvement in the veld cover. The vigour of the vegetation and, therefore, the total production of the veld is increased by the application of these systems at realistic stocking rates.

Improvement in the veld cover is slower in the dry, southern parts of the Ghaap plateau where Dorper sheep

are run, but with the improved weather conditions of the past two years there has clearly been improvement where the four and eight camp systems are applied.

In the Bechuanaland subregion it was established in the course of a survey that about 90 per cent of the farmers graze their veld according to their own judgement and do not take the principles of veld control into account. The stocking rate is consistently too high and the farms generally have too few camps to apply any system with success.

The farmers rest their veld chiefly to provide winter feed, and not to improve the veld.

Wool grass *Antheophora pubescens* is a natural grass of the Northern Cape with a good potential for grazing. Farmers are becoming interested in this grass for sowing in the veld and replacing the veld in the semi-arid parts.

In a trial carried out at the Vaalharts Agricultural Research Station the effect of management on the seed production of wool grass was studied. The removal of the previous year's growth by mowing or burning before the first rains increased the total seed production by from 50 per cent to 100 per cent in comparison with other treatments. The seed also ripens over a shorter period and can, therefore, be more easily harvested.

The strandveld of the West Coast in the **Winter Rainfall Region** is severely affected by wind erosion, which has assumed disquieting proportions.

In the past various species of drought-resistant grazing crops have been sown on the fields of the Nortier Experimental Farm with the object of establishing permanent plant covers. The following species were easy to establish and grew well:

Indigenous perennial klappiesbrak *Tetragonia fruticosa* indigenous perennial rooisaadgras *Ehrharta calycina* annual merriidin rye grass *Lolium rigidum*, annual harbinger medic *Medicago littoralis*.

Tetragonia fruticosa made so much progress on old lands during the past year that it is now regarded as the best grazing crop. However, animals that graze chiefly klappiesbrak in June and July are inclined to scouring and, therefore, another suitable perennial crop for use with klappiesbrak is required.

Trials are being carried out at the Nortier Experimental Farm to determine the effect of fairly light, selective seasonal grazing for three months in comparison with intensive seasonal grazing on the growth form and composition of the veld. The same stocking rate per season is used in all the trials, but the stock density differs.

The best results were obtained with grazing early in the growing season and a high stock density. There was an exceptionally large increase in the total cover of species in this treatment, chiefly owing to the large increase in edible *Ehrharta calycina*, and *Salvia nivea* (an edible shrub) and *Tetragonia fruticosa* (an edible herb). The cover of *Zygophyllum morgsane* (inedible, dominant shrub) decreased.

Where the veld was withdrawn from grazing entirely, the cover, including the cover of perennial grass, increased a great deal.

In the Montagu district a grazing trial is being undertaken to determine the response of Karroid broken veld to grazing during various seasons and combinations of seasons. So far it has been striking that despite the fact that the cover and edibility of the veld is very low, it has not been possible to effect any significant improvement in the veld by means of grazing control alone. This trial shows that veld improvement in this type of veld can only be effected within a reasonable period by radical methods, because the natural propagation of the desirable grazing plants is too slow.

Studies on the effect of temperature and soil type on the growth and development of bietou *Osteospermum sinuatum* have shown that bietou seed can germinate under different environmental conditions. This factor is very important in radical veld reclamation.

In the rotational grazing trial at the Nortier Experimental Farm in which 27 camps are being grazed in turn by one herd for periods of 14 days, the total crown cover has increased very significantly and klappiesbrak *Tetragonia fruticosa*, which is a valuable edible herb, has also increased a great deal.

However, the cover of *Ehrharta calycina*, an edible perennial tussock grass, has decreased on the whole.

In a trial at Nortier where the effect of continuous grazing by cattle and sheep on the veld is being measured, the cover of the veld has virtually doubled and its palatability composition has also improved a great deal. In this case the cover of *E. calycina* has also increased significantly, which supports the belief that this grass should not be cropped too short.

In the Worcester district a veld improvement trial is being carried out in mountain rhenoster bush veld with the object of reclaiming this veld as natural grazing. In 1967 and 1968 burning and bush slashing treatments were applied to eradicate the useless rhenoster bushes. A high percentage of bushes were eradicated in this way and since then there has been only limited re-establishment of rhenoster bush. Annual pioneer grasses and edible herbs are apparently increasing in this area.



Large areas of South West Africa had good rains last season, accompanied by a luxuriant growth of grass. This photograph was taken in the southern Karasberge and shows a good stand of *Stipagrostis brevifolia* with large aloes in full flower



Another scene of luxuriant grass growth after good rains in South West Africa – gemboktail grass *Stipagrostis hochstetterana* in the Omaruru district

In the attempt to establish grasses and herbs by sowing them in the veld, the best results were obtained with old man saltbush *Atriplex nummularia*.

During the past year bietou *Osteospermum sinuatum* was again successfully established on a number of new farms and there are now over 20 places where trial plantings have been successfully carried out.

In the central and especially in the southern parts of South West Africa the rainfall was exceptionally good during the past season. The central parts of the north had an average to below average precipitation. After the generally favourable conditions in 1970/71, when there was exceptionally good germination and establishment of perennial grass seedlings, the process was continued this year so that many farms can now boast fair to good stands, particularly of the transitional species.

The increase in climax grasses was slower but nevertheless satisfactory. The exceptions were the eastern half of the Outjo district, the subtropical bushveld north of Tsumeb and a narrow strip west of Tsumeb, up to the Outjo border, and part of the Kalahari.

The practical application of sound grazing management practices is still increasing satisfactorily. In South West the number of farmers who rest no veld at all is becoming a smaller minority. Moreover, farmers are making better and better gross and net farm incomes with lower stocking rates than the calculated carrying capacity for these parts.

However, the majority still falls into the middle group and applies veld management with varying degrees of efficiency. The chief shortcomings with regard to veld management are that farmers over-estimate the carrying capacity of the veld and so overload it, have too few grazing camps that are too big, keep an unnecessarily high number of herds and so make it difficult to apply good grazing systems and do not separate the veld types completely.

When it comes to herd and flock management, the chief malpractice that makes it difficult to apply good veld management systems is the failure to apply definite mating and covering seasons in Karakul flocks and cattle herds.

Fertilisation of the veld

In a veld fertilisation trial at the Towoomba Research Station significantly higher yields of air-dried matter are obtained where nitrogen and phosphorus fertilisation are applied together. At the highest level of fertilisation a yield of 5,97 metric tons per hectare was obtained as against the 2,48 metric tons per hectare produced by the control.

The botanical composition of the plots is changing from a climax type of veld to a virtually new stand of *Panicum maximum* and *Urochloa mosambicensis* under increasing fertilisation. The basal cover of the plots, however, is decreasing considerably at higher levels of fertilising.

A co-operative veld fertilisation trial conducted on rocky mountain sourveld in the Carolina district has demonstrated that balanced fertilisation can increase the productivity of such veld by 500 per cent with respect to grazing capacity. A small plot N x P x K trial conducted on the same terrain has indicated that although nitrogen is the chief yield determinant balanced P (phosphate) + K (potassium) fertilisation are also required to achieve the best economic return.

A small plot trial conducted at Nooitgedacht to determine the feasibility of directing changes in botanical composition of fertilised veld by oversowing has demonstrated that the success of establishment of the introduced species is highly correlated with the level of both nitrogen and phosphorus fertilisation.

A further trial has demonstrated that fertilisation of veld has possibilities in not only increasing the nutritional value of winter pasturage, but that it also has a strong beneficial effect on production in subsequent seasons. This information will now be applied on a practical scale.

At the Bethlehem Agricultural Research Station, where efforts are being made to transform old lands into good veld in a short space of time, *Digitaria smutsii*, *Eragrostis curvula* and *Themeda triandra* were overseeded on exhausted soil of the Rietvlei series. The grasses were broadcast and also established in 71 cm rows by means of a wheat planter. Half the plots received no fertilisation and the other half 80 kg of nitrogen per ha (limestone ammonium nitrate) and 13 kg of phosphate per ha (superphosphate).

On the unfertilised plots the treatments where *T. triandra* was overseeded produced the highest yield, and broadcast *E. curvula* produced the best yields on the fertilised plots. Overseeding *D. smutsii* did not help veld reclamation at all.

An old land covered by *Sporobolus pyramidalis* and other pioneer grasses at the Ukulinga research station was divided into eight 0,809 ha paddocks. Four paddocks at random were fertilised in the spring of 1969 and each subsequent spring with 272 kg of urea, 272 kg of superphosphate and 91 kg of potassium chloride per paddock. The remaining four paddocks were not fertilised.

Two-year old and one-year old beef animals were introduced and carried on the respective camps in

rotation till the end of summer and then, when masses started to drop, although there was still plenty of grass, grazing was supplemented by non-protein nitrogen blocks for a further two months.

The average number of mature livestock units carried per 3,24 ha was 10,6 on the fertilised plots and 4 on the unfertilised plots during the summer grazing period, and 11 and 5,6 respectively for the two month period with supplementary feeding.

The total animals mass change in kg per ha over the whole period was 375 kg in the case of the fertilised and 111 kg in the case of the unfertilised plots.

The results this season show that fertilising has increased the carrying capacity of the old lands by two to nearly three fold and there has been a slightly greater gain per animal per day on the fertilised plots.

In another experiment at Ukulinga to determine the effect of nitrogen dressings applied at different times during the season on the growth of veld and *Eragrostis curvula* two levels of nitrogen were applied to plots on the 1st day of each month from October to March.

The response to nitrogen applied on *Eragrostis* that was harvested two months after application was as follows:

October application	—	3 816 kg per ha
November application	—	4 715 kg per ha
December application	—	3 705 kg per ha

Yields for subsequent applications were progressively lower, but were in each case more than twice the yields of plots which were not fertilised at that time.

The residual effect of the fertiliser, determined by cutting four and six months after nitrogen application, was low, but yields were nevertheless higher than for plots that did not receive nitrogen.

The residual effect of nitrogen applied in February and March resulted in yields in October and November of 630 kg and 1 346 kg per ha, which was 2 to 5 times higher than for that plots not fertilised at that time.

The response to nitrogen applied to veld was similar to that to nitrogen applied to *Eragrostis*, with yields as follows:

October application	—	2 581 kg per ha
November application	—	3 480 kg per ha
December application	—	3 025 kg per ha

On the plots fertilised in February and March there was heavier seeding in October and November than on other plots, and yields were 1 684 kg and 2 581 kg per ha respectively, which was double the yield obtained on plots fertilised in October, November and December.

A veld fertilisation trial at Glen on two types of veld has been in progress for 17 years. The two types of veld represent veld at a climax stage (red grassveld) and at a pioneer stage (*Aristida* grassveld).

The pioneer veld benefits very greatly from a high level of nitrogen fertilisation, but this virtually has a depressive effect on the climax veld. This shows that red grassveld does not respond well to a lot of nitrogen, because only 100 kg of ammonium sulphate per ha a year produced increased yields. Heavier applications produced no extra increases in yields.

It was also found that it is certainly not economically justified to fertilise veld in the Central Free State when the rainfall is under 600 mm.

Bush encroachment

Injudicious grazing practices, especially overstocking of the veld and the lack of planned grazing control, are causing the natural climax vegetation to disappear to a large extent in large parts of the country, giving way to pioneer grasses, bush encroachment, other invader plants and harmful or poisonous plants.

In the eastern part of the *Orange Free State Region*, especially the South-Eastern Free State and Central Free State Subregions, bitter bush, resin bush, draaibos and springbokbos are the main invader plants. In the western and north-western parts of this region there is very heavy encroachment of black-thorn and umbrella thorn trees. Where this is most severe, practically no grass is left.

Various encroaching plants, the following being the most important, occur in the *Winter Rainfall Region*, and are spreading over larger areas every year: *Hakea*, *Pinus pinaster* (cluster pine), *Acacia cyclops* (rooikrans), *Acacia cyanophylla* (Port Jackson), *Acacia mollissima* (black wattle), *Albizia lophantha* (stinkboontjie) and *Leptospermum laevigatum* (tea tree).

These invader plants are all very well adapted to the higher rainfall parts of the Region, and they are slowly but surely crowding out the natural vegetation in some parts. The increase of hakea is especially disquieting. Biological control seems to be the only way of controlling the enormous and dense infestations of hakea in the mountains.

Rhenoster bush covers large areas of pasturage in the transitional area between Karoo and mountain vegetation, which should actually be grassveld with a reasonably high carrying capacity. There are also thousands of hectares of veld where scholtzbos and kraalbos constitute the predominant plant cover in the North-Western and Small Karoo Subregions — a sure sign that the veld is trampled out and overgrazed.

A wide variety of invader plants creates problems in the Highveld Region.

Thorn trees *Acacia karroo* remain a serious problem, especially on veld along rivers and on the ridges of the Bankenveld.

Various kinds of karoo bush (for instance *Chrysocoma*, *Pentzia* and *Euryops*) occur in the southern parts of the Region. At present it seems that control of bitter bush *Chrysocoma tenuifolia* with the aid of the bush cutter in winter may be effective.

Slangbos *Stoebe vulgaris* creates problems in the North-Western Free State and on the sandy soil of the Eastern Highveld.

Encroachment by ouhout *Leucosidea sericea* is assuming serious proportions in the Eastern Free State Subregion and in the vicinity of Memel. Some success has been achieved in controlling this plant with weedkillers.

Brakbos *Aster filifolius* encroachment is taking place rapidly in the Eastern Free State. Other invader plants are wild seringa *Burkea* and vermeerbush *Geigeria* in the Standerton district and the silver-leaf bitter apple *Solanum* in the Bankenveld.

Only effective veld utilisation practices will eliminate the problem of invader plants. Weedkillers can only alleviate it temporarily.

Bush encroachment is assuming serious proportions in most parts of the Bushveld. Veld abuse, the effects of protracted drought and the fact that veld fires are a thing of the past in the Bushveld, all contribute to the process of bush encroachment.

Trees such as black-thorn, umbrella thorn, knobthorn yellow thorn and sickle bush are slowly but surely crowding out the grasses of the Bushveld. Areas where there were previously open parkland communities are now so covered in bush that grazing is difficult.

The encroachment of woody species in the grassveld of the Eastern Cape Region is still one of the most important problems there.

An investigation carried out in this Region to determine the effect on *Acacia karroo* seedlings of the

frequency of burning, protracted resting and controlled grazing was concluded after eight years. It was found that not one of these control methods prevented the establishment of seedlings once there was an established source of seed. Even where the veld was burned every year of every second year, the fire had no effect on the establishment of thorn tree seedlings.

Similarly there was no significant difference in seedling establishment between camps left totally ungrazed and camps where controlled grazing with sheep and cattle was applied. However, there was a direct connection between the level of re-establishment and the density of the original stand of thorn trees.

It was concluded that re-infestation must be expected after the removal of bush and that special measures must be taken to counter re-infestation. The introduction of goats very effectively prevented the establishment of thorn tree seedlings.

Another interesting result of the investigation was that there was no indication of periodicity in the establishment of thorn tree seedlings. Seedlings germinated and established themselves even in the driest seasons.

The occurrence of the undesirable exotic grass, New Zealand tussock grass *Nasella trichotoma* was this year confirmed in the Barkly East district. This is worrying, since experience in New Zealand has shown that this grass is very aggressive and spreads easily. Attempts are now being made to limit the spread of *Nasella* by eradicating relatively sparse infestations.

Research on the control of other invader species has continued, but results with regard to blinkblaar *Rhamnus prinoides* and the various jakkalsbos *Diospyros* species were disappointing. It would seem that there is at present no effective weedkiller for the control of these kinds of bush, which are important invader species in some parts.

Bush encroachment in mountain areas and the increase of undesirable plant species everywhere in the veld is a phenomenon increasingly seen in the Karoo Region. It indicates a gradual deterioration in the natural grazing.

Methods normally used to control these invader plants are mechanical uprooting, burning and control with weedkillers, but none of these methods seems to be absolutely effective. The best results are obtained by applying a combination of these methods in conjunction with judicious veld management.

Weedkillers are being tested and preliminary results indicate that Tordon 10 K gave the best control of the fine-leaved karee *Rhus erosa*. The cost per unit of area seems to have been very high, however.

Invader plants and shrubs that occur generally in the Karoo Region are resin bush *Euryops* spp., rhenoster bush *Elytropappus rhinocerotis*, sweet thorn *Acacia karroo*, fine-leaved karee *Rhus erosa*, box thorn *Lycium* spp., kraalbos *Galenia* sp., ouhout *Leucosidea sericea*, ironwood *Dodonaea africana* and grasses such as wiry danthonia *Danthonia disticha* and New Zealand tussock grass *Nasella trichotoma*.

There is also a tremendous increase of certain kinds of aloe, such as *Aloe feros*, *A. broomii* and *A. striata* in the Eastern Karoo and the Karoo Midlands during July and August.

Prosopis juliflora is taking over large parts of the water-course veld in the Carnarvon ward and has already spread over an estimated 2 000 ha.

There is no change in the area occupied by scrub in South West Africa. The density of the existing stands, however, is gradually diminishing, especially where the grasses are increasing through good veld management. The advantage of this natural change is experienced by many farmers. For this reason the conviction is gaining ground that a policy of physical development (more camps), good veld and herd management, understocking with cattle and the inclusion of goats, is immediately rewarding and leads to lasting recovery of the veld.

This ecologically sound policy has definitely contributed to the doubled total quantity of beef produced in South West during the past decade.

The alternative approach, viz to wage war on the scrub at great expense, especially with mechanical methods, was rejected because it is expensive and provides no lasting solution.

The results of the Omatjenne trials, where improved boer goats are tested in comparison with, and in conjunction with, cattle, confirm the results obtained in previous years. It is becoming more evident that a rate of 1,2 hectares per small stock unit (goat) amounts to overstocking of the available browse.

It is further observed that the goats are making progressively more use of the dry grass during the dry early part of summer, whereas at the beginning they completely ignored it. The carrying capacity for goats in the thorn veld of the northern part of South West is probably between 2 and 4 hectares per small stock unit.

Veld weeds

Jointed cactus

Spraying trials carried out in the Eastern Cape and Natal showed that jointed cactus can be controlled more effectively with Tordon than with 2,4,5-T. A full-time control programme aimed at destroying this extremely harmful weed is at present under way.

In the Eastern Cape inspection area, which includes parts of the Karoo Region, the area of infested farm land increased by 36 210 ha (2,3 per cent) during the past year and at present is 1 603 273 ha. Only about half of this area is really infested, and it is encouraging to be able to say that on more than 621 000 ha (77 per cent) of the infested area the weed is already under control.

In the Free State Region jointed cactus infestation is found on 6 511 ha, on about 40 per cent of which it is already under control. Infestations on 48 farms in the Natal Region are being prevented from spreading.

Widespread infestations in other agricultural regions are under control.

Biological control is being applied. Under favourable climatic and other conditions cochineal and *Cactoblastic cactorum* have been known to attack and drastically reduce severe infestations of jointed cactus.

Transport costs of spray have been subsidised by the Government since 1 April 1971, but despite this over 1¼ million litres less spray was used against jointed cactus during the year under review. Altogether 4 577 400 litres of spray was issued during the year under review.

The chief problems in the campaign against jointed cactus are a shortage of competent labourers and financial considerations.

Imbricate cactus

During the year under review 8 new applications for spray for the control of imbricate cactus were received and 28 400 litres of spray was issued.

There are still slight infestations in the Eastern Cape and Winter Rainfall Regions, and 11 259 ha in the Karoo Region is infested with this weed. In the Free State Region 34 050 ha on 174 farms was declared infested; on 17 620 (52 per cent) the infestation is thoroughly under control.

Farmers whose land is heavily infested find it very difficult to control this formidable weed effectively.

Attempts to control imbricate cactus by biological means, using the cochineal insect, were very promising. During the past year the insect was distributed at Barkly West, Douglas and elsewhere and it multiplied rapidly and with good results everywhere.

Opuntia tunicata infestation occurs on nearly 2 000 ha in the Douglas district; 57 per cent is already under control. This weed, which used to be mistaken for imbricate cactus, may be similar to jointed cactus in the damage it does.

Prickly pear

During the past year 7 new applications for spray were received, as against 9 the previous year, to deal with prickly pear that had been chopped down and piled. The quantity of spray issued for this purpose was 14 600 litres less than during the previous year. The sharp decline in control measures against prickly pear may be ascribed to drought conditions; during drought the use of prickly pear as a supplement for stock also increases.

The only areas where prickly pear poses serious problems are the Karoo and Eastern Cape Regions, but an *Opuntia* species is also spreading in South West Africa and the Grootfontein area. Spraying with a 2 per cent solution of 2,4,5-T ester was fairly successful.

Biological control by means of cochineal is progressing very slowly because the insect spreads slowly and ineffectively. It is feared that the natural rate of increase of this species of prickly pear is faster than the rate at which it is being controlled.

Lantana

Lantana camara is endemic in subtropical areas with a high rainfall and, therefore, occurs chiefly in the coastal districts of the Eastern Cape Region and Natal.

In the vicinity of East London landowners are co-operating well in controlling this weed.

Conditions in Natal are improving and campaigns in the Midlands and along the northern border of Natal were so successful that the weed is only found isolated in old wattle plantations or in deserted spots.

Hakea

The rate at which hakea is increasing in the mountains of the Winter Rainfall Region and encroaching on the indigenous vegetation is disquieting. Owing to the high cost of control private landowners are very reluctant to eradicate this weed.

Biological control seems to be the best solution and here insects such as the snout beetle, which hampers fruit formation in hakea, the seed-eating larvae of the moth *Caposina antolaga* and the seed-sucking stinkbug are at present being tested.

In the Eastern Cape Region the control of hakea is progressing well. The 3 750 ha near Port Elizabeth that were infested are almost completely under control and 19 400 ha of the infestation of 32 700 ha in the district of Humansdorp are under control.

The control of hakea is progressing well in the Natal Region, where it is confined to a patch near the Transkei border. In other agricultural areas hakea presents no problem.

Sand bramble. This weed occurs only in the Eastern Cape Region and Natal and is being given the necessary attention there.

Dodder

This weed is widespread in the Republic, particularly along rivers.

In the Little Karoo almost all irrigation farms where lucerne is grown are infested with dodder. It is considered the most harmful type of weed in those parts. The extensive infestation often found in grain fields where control is impractical is the chief cause of the rapid spread of this problem weed.

Silver-leaf bitter apple (satansbos)

In the Kendrew area silver-leaf bitter apple infestations on 6 271 ha of fields were sprayed at least once, and in addition the weed was treated with spray over a distance of more than 1 970 kilometres along roads and on the banks of rivers, canals and irrigation furrows.

Since the percentage regrowth is high the campaign at Kendrew can only be completed after four seasons. Chemical treatment is being discontinued until a more effective preparation has been found.

This weed occurs in 22 places in the Eastern Cape Region. In Natal it is confined to the Ladysmith district, where Tordon 22K has been used for the past four years.

About 512 hectares in the Central Free State is infested with silver-leaf bitter apple, and there are light infestations in Bechuanaland and Griqualand West. No control is applied here.

On account of the high cost of control silver-leaf bitter apple is increasing seriously in the Highveld Region.

Saint John's Wort (Hypericum sp.)

Efforts to control this hardy weed of the Winter Rainfall Region should not be relaxed, even if total eradication appears to be hopeless.

Biological control with the imported *Chrysolina* beetle is not very effective.

The value of the gall midge *Zeuxidplosis giardi* at present being imported from Australia in controlling St. John's wort will be investigated shortly.

Harrisia martinii

The infestations of *Harrisia* at Ashburton and Muden were successfully sprayed with 2,4,5-T.P.

Inkberry

Farmers are co-operating well to control inkberry, which occurs mainly in the vicinity of East London, Bathurst and Port Elizabeth.

Camel thorn bush

About 100 ha of irrigated land in the vicinity of the Beervlei Dam in the district of Willowmore is infested with camel thorn bush. So far control with arsenic pentoxide has yielded good results.

Water weeds

Hyacinths, duckweed and water fern are still widespread in virtually all agricultural areas and are being controlled.

Other weeds

Pereskia aculeata is a thorny cactus of a runner variety and is becoming a serious problem in the natural forests of the high rainfall areas of Natal.

Anathasia acerosa (Curry's post) occurs chiefly on the mountain slopes of Natal and may best be controlled by judicious veld utilisation.

Spiny cockle-bur, large cockle-bur, Scotch thistle, star thistle, thorn apple, wild tomato and other annual weeds occur in all the agricultural Regions; regular campaigns are waged against them.

Poisonous veld plants

Gifblaar remains the worst poisonous plant in the natural grazing of the Transvaal Region. The two districts that are worst affected are Ellisras and Thabazimbi, where several thousand morgen are infested.

There are chemical preparations on the market, that kill the plant effectively, but the cost is high. The well-known method of killing gifblaar with copper sulphate (blue vitriol) also works very well, but requires a lot of labour. In some cases camps have to be treated 10 to 14 times before they are completely clear of gifblaar.

Gifblaar occurs on a smaller scale in other regions, such as the Eastern Cape and South West Africa. During the critical spring period only camps that contain no gifblaar are grazed.

Gousiekte bush, which occurs chiefly in the Highveld Region and to a lesser extent in the Eastern Cape Region, may be economically controlled by weedkillers without affecting the natural grazing.

In the Western Transvaal it was established that sheep eat gousiekte bush more readily than cattle do. However, if a sound system of veld management is applied stock losses on account of the gousiekte bush can be cut down.

Vermeer bush, which was regarded as one of the biggest threats to the livestock industry in Griqualand West 15 years ago, is considered a relatively minor problem today.

It was established in the course of grazing trials that vermeersiekte can be controlled by increasing the grazing pressure and at the same time reducing the grazing period. This means that the intake of vermeer bush may be reduced by judicious grazing practices.

Tulp occurs in most of our agricultural Regions, particularly in low-lying areas and on old lands. Farmers are not greatly concerned about the spread of tulp because stock losses from tulp poisoning occur virtually only when strange cattle graze tulp-infested veld.

Senecio pterophorus is a new pest that is spreading rapidly in the grassveld in the high-rainfall areas of the Eastern Cape, Natal and other parts. During the past year this weed was so bad in parts of the Eastern Cape Region that it suppressed the grazing completely.

Only a few farmers are controlling this weed. In the Port Elizabeth district good results were obtained with a bush slasher.

The occurrence of *Senecio*, *Homeria* and *Matricaria* is causing grazing problems in Natal because effective and practical control methods have not yet been found there.

Senecio retrorsus is the worst poisonous plant problem in the Eastern Cape Region and research on the eradication of this poisonous plant is in progress at present.

Slangkop is occasionally found in the drier parts of the various agricultural Regions where it generally causes deaths during the early part of the summer when grazing is scarce. Farmers pull the weed mechanically and clean the grazing camps systematically.

Poison onions occur on a few farms in the Douglas district. It is only in early summer that the plants are a problem. So far no solution has been found to this problem.

4. Field Husbandry

MAIZE

Production trends

Maize production is still showing a rising trend and an average growth rate of six per cent has been maintained over the past twelve years. On the basis of the increase in production over the past 20 years, it is estimated that the Republic will produce about 12 million tons of maize by 1982.

The consumption of maize has increased to five million tons, 1,6 million tons of which is used as stock feed.

It is estimated that the total consumption for 1982 will be 9,3 million tons. The chief production problem is the control of diseases of maize such as stem and root rot and boil smut.

Maize is still the chief cash crop in the Highveld Region, and even on the Bankenveld where grain sorghum cultivation has increased at the expense of maize production, maize still represents 80 per cent of the grain grown. In the Eastern Free State where the area under maize has shown a declining trend over the past 20 years, with an accompanying increase in the area under wheat, there has been a swing during the past year and maize production is apparently expanding again — at the expense of wheat production.

In the Free State Region there have been a number of problems with new hybrids with regard to suckering, poor ear formation and small ears. Such problems have caused considerable crop losses. Old tried and trusted hybrids such as S.A.4, S.A.5, S.A.9, S.A.11, S.A.100, S.A.200 and PPKx64 were again real standbys in this Region.

Maize production in Northern Natal has increased by 21 per cent since 1966/67 and the consumption of fertilizer by 130 per cent. Indications are that this rapid rate of increase will be maintained for at least five years.

As the result of a good season and improved cultural practices maize production in the Eastern Cape increased by about 20 per cent.

Farmers in the irrigation areas of the Karoo Region have become more interested in the production of maize and good yields were obtained.

In South West Africa larger and larger areas are being planted to hybrid maize, which is better adapted

to the short and uncertain rainy season, and local selections are slowly disappearing.

Late plantings of maize in January were damaged by early frost (1 May 1972), but nevertheless 100 000 bags are expected to be delivered to the mill at Otavi.

Breeding and selection

More than twice as many maize cultivar trials as previously were carried out in the Highveld Region during the year under review and far more attention was given to the proper interpretation and practical application of experimental results than was the case in the past. One example of this approach is that disc diagrams were developed that show how certain soil and climatic factors may be integrated in order to prepare yield estimates for various crops.

As soil and climatic norms are identified it will be possible to integrate them and determine yield norms. When the field and veld units of a farm have been identified, evaluated and integrated, the best utilisation system can be determined.

A number of entries that show some degree of resistance to cob and tassel smut were multiplied in order to make crosses.

The strains used in South African hybrids have now been back-crossed to crosses with the high-lysine types for five generations. Researchers will now concentrate on improving the dent type by breeding for a more acceptable hard type.

The most popular cultivars in the Transvaal Region are S.A.4, S.A.100, PPP x K54R, SA9N, SSM40 and certain Pioneer hybrids.

Eighteen maize cultivars were tested on dryland at Glen and an average grain yield of 1 423 kg per ha was obtained. The best results were obtained with DS63 (1 696 kg per ha), SSM40 (1 693 kg per ha), DS23 (1 678 kg per ha), DS15 (1 562 kg per ha), S.A. 4 and Pioneer 22 (1 553 kg per ha).

Disappointingly low yields were obtained from Pioneer 99 (998 kg per ha), Pioneer 55 (1 033 kg per ha) and S.A.17 (1 074 kg per ha).

Eighteen different maize cultivars were tested under irrigation on the Sand Vet scheme. The cultivars Sabi III and DS 63 were among the best producers, with



Lights in the maize field! These 300-watt lights were used for a photo-period test with maize at the Makatini Research Station

a grain yield of 8 000 kg per ha. All the cultivars grew very luxuriantly and produced good stalk yields.

None of the present commercial maize hybrids has satisfactory resistance to streak. The new hybrid S.A.32 from the breeding programme at the Vaalharts Research Station has a high resistance to this virus disease and will be multiplied for commercial seed production.

Several new maize hybrids did considerably better than S.A.32 in 1971/72. The best production by a new white single hybrid was 122,5 bags (of 90 kg each) per hectare, whereas S.A.32 was able to produce only 61,7 bags per hectare under the same conditions.

Natal regional maize yield trials, which are planted at seven different localities, again showed the tremendous potential of some hybrids.

Kokstad with 121,9 bags (90 kg) per ha, again had a very favourable year having now recorded the highest individual yield for two successive seasons. The localities Bergville with 117,9 and Dundee with 109,4 bags per ha follow next.

Commercial hybrids featuring in the top rankings are PNR353W, SR 52, and S.A. 15, the last-named having also been the highest average yielder in 1970/71. Experimental hybrids that have again featured amongst the highest yielders are the Regop hybrids, Regop 1 probably being the best this year.

Planting methods

As the principles of optimal land use are becoming accepted farmers are adapting their plant populations to

the production potential of various fields to a greater and greater extent.

Planting methods, and particularly row width, are being purposefully used to solve specific problems. In the Eastern Highveld 2,1 m rows are used to control weeds. In the North-Western Free State this planting method lends itself to the making of wind furrows to control wind erosion.

In the Bothaville and Viljoenskroon districts a number of farmers are planting in 1,5 m rows and then cultivating with small implements. In this way high-potential soils in the North-Western Free State are put to better use, while effective weed and drift-sand control is still possible. The low rainfall of the South-Western Transvaal is utilised best when 2,1 m rows are planted, and 1,5 m rows are also becoming popular where the potential is higher than the average for the region — for instance on soil series that have the property of storing free water in the root zone.

In the case of potentially highly productive soils and class 1 soils with a good rainfall in districts such as Nigel and Bethal the tendency is towards narrower rows than the conventional 0,9 metre rows, and row widths of 0,7 to 0,8 metres are used, which means higher plant populations.

Trials at the Bethlehem Research Station have shown that the yield from maize grown under the monoculture system gradually drops until it reaches an equilibrium, after which it remains constant and varies only according to the rainfall. It was also clear that maize uses nitrogen and potash more efficiently where it is planted in a rotational cropping system. No phosphate responses were obtained, probably because this element was applied in adequate quantities, even where the annual applications were relatively low.

Nitrogen purchases in the South-Western Transvaal virtually doubled for the second successive year: during the year under review about two million metric tons of nitrogen fertilisers more than the previous year were sold.

It was shown in the course of soil analyses at Glen that annual applications of phosphate at the rate of 79,5 kg of superphosphate per ha (8,3 per cent P) over a period of 12 years did not succeed in raising the low phosphorus status of the soil.

Diseases and pests

Owing to the good rains during the year under review various diseases that normally occur sporadically were fairly common in the Highveld Region. These included leaf blight *Helminthosporium turcicum* and bacterial leaf spots.

Boil smut *Ustilago maydis* and cob and tassel smut *Spacelotheca maydis* occurred less than in previous years, probably as a result of the relatively low temperatures during the first half of the growing season.

Root rot was fairly common, but owing to the good rainy season the results of root rot diseases were not very striking. Diplodia stem rot occurred very seldom, but cob rot caused a great deal of damage, especially in the South-Western Transvaal, a fact which must be ascribed to the excess of rain during the ripening period.

It would appear that virus streak is assuming more serious proportions than in the past.

In the Eastern Highveld cutworms, stalk borers and bollworms have taken their toll during the year under review. Aphids on the tassels are increasing and farmers had to resort to aerial spraying. About 6 000 ha was sprayed at Bethal.

In the North-Western Free State first and second generation maize stalk borers again caused serious damage this year.

An ecological study of the maize stalk borer conducted in the Highveld Region over the past five years shows that there is a definite time lag between the first and second generations every year. The second generation only starts during the first half of February.

Infestations tend to be more severe in the eastern parts than in the west. A sparse third generation occurs in the west, but is of no economic importance. Maize planted during November is less subject to second generation infestations than December plantings.

The maize chafer beetle *Adiretus cribrus* again struck unexpectedly this year and caused serious damage to crops in the Transvaal Region.

Infestations of the mite *Tetranychus urticae* on maize plants are common on the Transvaal Highveld. This is a new pest and it is not yet known what damage it causes and how widespread it is.

In the Central Free State tassel smut occurred in early plantings this year. Root diseases in the Bechuanaland Subregion and cutworms, stalk and ear borers and diplodia in the Griqualand West Subregion were also among the diseases and pests that played an important part in reducing crops.

The Taxonomic Mycology Section of the Plant Protection Research Institute traced downy mildew of maize and sorghum on farms in the Springbok Flats where from 15 per cent to 40 per cent of maize plants were infected in fields with heavy clay soils. No downy

mildew was found on plants growing in sandy soils. In this area the causal fungus was identified as *Sclerospora sorghi*, a species which attacks maize and species of sorghum.

In the Eastern Transvaal this disease was not found on maize. In the Western Transvaal the disease was found near Delareyville where about 4 per cent of plants in a field with clayey soil had crazy top symptoms.

The pink maize stalk borer *Sesamia calamistis* is still causing problems in the cultivation of sweetcorn in the Winter Rainfall Region. Monocrotophos and methomyl performed very well against this caterpillar in field trials.

Imports and exports

Far more maize was exported during the year under review, viz 1 970,7 million kg as against 397,1 million kg last year. This is an increase of 1 573,6 million kg.

The number of phytosanitary certificates issued was:

1970/71 — 420
1971/72 — 498

The largest quantity of maize was exported ex the port of East London, viz 910,6 million kg, followed by the port of Durban with 717,523 million kg. A small quantity, viz 1 693 kg, was imported under quarantine, chiefly for research and breeding purposes.

WHEAT

Production trends

Despite considerable fluctuations, wheat production in South Africa has shown a rising trend since 1951/52, with an average annual increase of almost 31 000 metric tons. During the same period local consumption of wheat increased steadily by about 26 500 metric tons a year.

Present production exceeds local consumption and it has become necessary to export wheat.

The fact that the baking quality of about 65 per cent of the wheat grown in South Africa is poor, creates problems with regard to both local consumption and exports.

Poor rainfall caused a drop in wheat production in the Swartland. Leaf and stem rust and *Septoria nodorum* greatly reduced the grain yield from cultivars.

Although vegetable production in the South-Western Districts increased, interest in wheat growing is still increasing, even in the higher rainfall areas. The chief problem remains the susceptibility of the cultivars to various rust strains, and the lack of adequate drying facilities when all the producers harvest at the same time.

During the past eight years the area under wheat in the Highveld Region has risen from 8,4 per cent to over 20 per cent of the total cultivated area. In the Ficksburg and Ladybrand districts production dropped as a result of the serious aphid infestations during the preceding seasons. In the North-Western and Eastern Free State there were considerable rises in wheat production.

The total production of rather more than 600 000 bags at Vaalharts is not only a record crop, but also shows the tremendous potential productivity of the irrigated area when highly productive cultivars are planted. About 75 per cent of the wheat produced is of class B quality.

Wheat cultivation increased tremendously in the Gordonia, South-Western Free State and Griqualand West Subregions. There was slight expansion in the Central Free State. The great increase in wheat production in Griqualand West is ascribed chiefly to the good results obtained with short straw cultivars and high levels of nitrogen fertilising.

The fact that the harvesting process can be fully mechanised is helping to make wheat growing very popular in these parts.

Since the introduction of short straw cultivars, winter wheat under irrigation has become an attractive economic proposition in Northern Natal. Yields of over 35 bags per hectare are common and only lack of sufficient irrigation water is likely to limit the production potential of this area.

Very satisfactory dryland wheat yields have been obtained on the deep Leksand soils at the Dundee Research Station. Farmers are as yet hesitant to adopt dryland production on any appreciable scale, but provided the correct soils are selected and soil moisture conservation practices are adopted during the summer months there would appear to be a bigger potential for dryland than irrigated wheat in the Natal Region.

Wheat production in the Eastern Cape coastal and inland areas more than trebled over any preceeding year. The area planted to wheat increased further this year.

Breeding and selection

Ten yield trials were planted at the Langgewens and Tygerhoek experimental farms and 87 (23 per cent)

of the international acquisitions did significantly better than the standard cultivars. Twenty strains at both sites did comparatively well and showed wide adaptability. The remaining 60 strains have specific adaptability for either the Rûens or the Swartland.

Since considerable quantities of durum wheat have to be imported annually to meet local requirements, a durum breeding programme was started in 1970 and this year it will be possible to start work on selections in the advanced generations.

Trials conducted with the best acquisitions during the past two years showed that the *Triticales* compare favourably with wheat under favourable conditions. At the Tygerhoek experimental farm the grain yield of the four best *Triticales* was almost 200 kg more per ha than that of the four wheat standards. The hay yield from the best *Triticales* was better than that from wheat, rye and oats.

During the few past seasons only a few short straw cultivars did well on highly fertilised soil and they are recommended for the South-Western Districts.

T4 with a yield of 36 metric bags per ha, Zambezi (29) and Tobari (26) were among the most productive.

Of the cultivars with a long growing season Tosca, with a yield of 34 metric bags per ha, and Janitor (33) are still among the best that can be recommended.

In view of the experimental results obtained the sowing of spring wheat in the Winter Rainfall Region cannot be recommended at this stage.

Twenty-three conventional cultivars were included in the variety trial under irrigation at Oudtshoorn. The cultivars, in order of productiveness, are the following: T4, Mengavi, Lee Mida and Crim with yields of 51,4, 50,2, 48,6 and 46,9 bags per hectare respectively. Although Lee Mida had a 75 per cent stem rust infection and a 100 per cent leaf rust infection, the yield and bushel mass of 63,0 were satisfactory.

Short straw cultivars grown under irrigation with adequate fertilising yielded well. Tobari produced the highest yield, followed by Zambezi and Norcesti.

The cultivars that did best in the Uniondale area on dryland were Zambezi, K20 and Gamenya.

In a back-crossing programme at the Bethlehem Research Station the resistance to stem rust of *Triticum timopheevi* and *Agropyron elongatum* was successfully transferred to Flameks, Heemraad, Betana, Sterling, Kenya Sokkies and Scheepers. Various rust-resistant Flameks strains with long and short growing seasons

were developed and are now being evaluated for adaptability in various areas.

In monthly variety trials from April to November Scheepers, Scheepers '69 and a derivative of Scheepers produced constant and relatively high yields at all planting times. Bella yielded better than Betta when they were planted in April and May. Scheepers '69 and Betta are fairly generally accepted by wheat producers.

Wheat cultivar trials at Vaalharts, and on the Sand Vet and Riet River schemes proved that the two class B cultivars, viz T4 and T8, are the most suitable cultivars for growing under irrigation in the Free State Region. The grain production from the best class A cultivars, Inia 66 and Zambezi 2, was significantly lower in all cases than production from T4. The average production of the four recommended cultivars was as follows: T4 – 74,4 bags per ha, T8 – 70,7 bags per ha, Inia 66 – 64,7 bags per ha, and Zambezi 2 – 63,0 bags per ha.

Planting methods

The effect of four row espacements and four seeding densities (plant populations) on the grain yield of two different wheat cultivars under irrigation was determined at three places in the O.F.S. Region on a soil of the Hutton form and Mangano series.

No significant differences could be found between 80 kg, 120 kg and 160 kg of seed per hectare. All three seeding densities were significantly better than 40 kg of seed per hectare, particularly in the case of a cultivar such as Inia 66 that stools relatively little. Similarly no significant difference could be found between row widths of 15 cm and 30 cm, but they were both significantly better than row widths of 45 cm and 60 cm. Weed penetration was visibly more in the wider espacements.

On a trial plot on the Bethlehem Agricultural Research Station where wheat has been grown continuously for 15 years, no root diseases or other diseases have developed and there is no indication that yields are being reduced by continuous cultivation.

Four levels of nitrogen application were tested with four different wheat cultivars under irrigation on sandy soils of the Hutton form and Mangano series in the O.F.S. Region.

Wheat yields continue to rise when nitrogen application is increased, even when it reaches 170 kg of nitrogen per hectare. Relatively high wheat yields of 82 bags per hectare were obtained.

With regard to grain yield the class B cultivars performed better than class A cultivars throughout. The



Visitors inspect a wheat cultivar test at the Cradock experimental plots

best Class B cultivar, T4, produced a 15 per cent higher grain yield throughout than the best class A cultivar, Inia 66.

Diseases and pests

A new insect pest of wheat, the aphid or wheat aphid *Macrosiphum* (sitobium) *avenae* has become a serious problem from Nelspruit in the east to as far west as Zeerust within a single season. Farmers have even sprayed twice to try to control the aphid, which collects chiefly on the ears.

Jumping plant lice have also increased in number and are probably responsible for the complaints received about streak in wheat.

For the first time adult insects of the Chloropidae family have been collected in fields at Groblersdal. The wheat aphid again occurred and aerial spraying was applied in some areas.

A serious soil-borne disease of wheat was investigated on the Springbok Flats by the Plant Protection Research Institute. It was revealed that a general infection by a *Rhizoctonia* sp. occurred in virtually all the turf soils where wheat is grown. Symptoms above ground-level took the form of plants dying in patches at the seedling stage. The plants are being re-infected and the possibility of chemical control examined.

Wheat aphid infestations were very severe in the Brits district during the past season. Powdery mildew

was found, especially on the cultivars Inia, Tobari and Tokwe.

Severe foot rot and crown rot occurred in the Griqualand West and Central Free State Subregions because the rotational cropping system had been abandoned on account of the economic success obtained with wheat production. Aphid infestations occurred in virtually all the wheat-producing areas of this Region.

Root diseases of which *Ophiobolus* is the most important caused considerable crop losses in wheat, especially where legumes and wheat are planted near to each other. Growing oats before wheat is planted in infested soil solves the problem in almost all cases.

During 1971/72 wheat aphids caused enormous crop losses.

OATS

The good wheat prices worked against expansion of oats production in the Winter Rainfall Region and in the Vaalharts district. This is rapidly leading to a monoculture situation, with detrimental results for the wheat industry. Because of greater interest in the cultivation of cash crops under irrigation less oats is being planted in the Karoo Region as well.

Oats is being replaced by wheat even for grazing purposes, because the possibility of a cash crop after grazing of the wheat has additional financial advantages. In the Eastern Highveld and North-Western Free State, oats is cultivated mainly for grazing.

The maintenance of purity and the provision of foundation seed are attended to at the Langgewens, Tygerhoek and Elsenburg experimental farms. During the year under review, 10 bags of foundation seed were supplied to the Wheat Board.

Yield trials at the Tygerhoek Experimental Farm showed that it is unlikely that dramatic increases in yield can be achieved with irrigation. In the Swartland and South-Western Districts, cultivars from Florida, the U.S.A., did exceptionally well after they had been selected the previous year according to their performance in a single-site trial. Two locally cultivated lines did as well in these districts and their resistance to disease is outstanding.

At Vaalharts the cultivar Alaska produced the exceptionally high grain yield of 77,6 bags per ha and a hay yield of 27,3 metric tons per ha. Under the same conditions Langgewens produced only 54,3 bags per ha and 16,3 metric tons of hay per ha. Before application is made for commercial release, the cultivar is being tested over a wider area, while about 2 ha is being planted for multiplication.

Atmospheric diseases, especially stem and leaf rust, are epidemic to most of the commercial cultivars. This stresses the necessity of providing the industry with disease-resistant types.

In the South-Western Districts, strains susceptible to disease can easily be identified, and early types were identified in the Swartland. After the successful testing of two strains, it was decided to multiply them quickly with a view to release.

At Vaalharts oats is planted on soil not suitable for wheat production, owing to infection by the foot rot fungus *Ophiobolus*. After oats has been planted on it, such soil can usually be used for the cultivation of wheat for two or three seasons.

In the Winter Rainfall Region, rotational cropping in a wheat programme with oats is also receiving attention, because some of the wheat root diseases cannot survive on oats.

BARLEY

The Winter Rainfall Region is to a large extent the barley store of the Republic. The increasing production of wheat, however, has depressed the production of barley to such an extent that a shortage of barley is now being experienced in the country.

A successful barley evaluation trial was done in five places, and five strains did well. Three of these

strains, 60/19-30A, 60/2-84A and 60/19-58, are being multiplied with a view to possible release.

At the Langgewens Experimental Farm, some indication was obtained of the yield and adaptedness of cultivars from those parts of the world with climatic zones corresponding to parts of the Winter Rainfall Region. Some Australian types did well, although some of the European kinds also have good possibilities. The Australian 2-row Clipper cultivar produced significantly higher yields than the local standard cultivar, Swanneck. The high humidity and good rainfall of this region encourage disease conditions so that disease-resistant kinds can easily be identified. These favourable conditions also make it easy to identify inherently weak producers.

Barley yellow dwarf was once again of general occurrence, especially in the South-Western Districts. Especially characteristic was the severe infection on the cultivar K20. This disease was also found to a lesser extent in the Swartland. In breeding new cultivars, priority is given to those with some resistance to this disease.

GRAIN SORGHUM

The grain sorghum harvest of the Highveld Region is about 70 per cent of the country's total production. In the Bankenveld production rose to five times that of the previous season, in the South-Western Transvaal it doubled, and in the Eastern Highveld production is also increasing.

In the past two decades, the area under grain sorghum increased by more than 50 per cent — from 130 000 to 200 000 ha — while the production per surface unit almost doubled — from 600 to 1 100 kg per ha. In the Eastern Highveld, however, this average was considerably exceeded; yields of 4 000 to 5 000 kg per ha were common.

Even in the drier districts of the Eastern Free State and on the heavy soils in the districts of Bethlehem, Reitz and Harrismith, the production of grain sorghum is receiving more and more attention.

Only in some districts of the Central Highveld (such as Heilbron) and in the North-Western Free State (Parys and Koppies) was there a noticeable drop in production. This is attributed to grading problems and the large-scale lodging of plants in the past few years.

In the Free State Region, more and more grain sorghum is being planted because this crop is more drought-resistant than maize.

The grain sorghum cultivar SSK2 yielded more than 36 bags per ha in the Brandfort district



On the Springbok Flats grain sorghum is being progressively replaced by sunflower and a downward trend was also observed in the Northern Transvaal, in the latter area mainly on account of the large losses caused by finches and the grain sorghum midge.

In the Central Free State Region, good seed is being used more and more, and locally cultivated selections such as the SSK types have the potential for high grain and hay yields.

Cultivars such as SSK 2 give the best results if planted in 7 foot rows with a plant population of 40 000 plants per hectare.

Aphids, maize stalk borers and bolworms were once again a nuisance on grain sorghum in three subregions of the Highveld region, and poor crops could only be prevented by timely spraying. In the Central Free State aerial spraying gave good results.

Investigations to determine the effectiveness of spraying against grain sorghum aphids and the effect the insecticide has on the natural enemies of the aphids was carried out at the Towoomba Agricultural Research Station. The best results were obtained with demeton-S-methyl, which gave total control with doses of 56, 116 and 170 ml of active constituent per hectare. Monocrotophos had the most lasting negative effect on the population of natural enemies.

The application of disulfoton pellets in the soil at 0,5 1,0 and 1,5 kg per ha just before planting for aphid

control, was also investigated at Towoomba. In the two trials significant control at all concentrations was achieved throughout the season.

Other trials showed that the greatest damage is done by aphids during the flowering stage.

Further batches of two Aphidiidae parasites imported from the U.S.A. were released in three places. To date signs have been found only of primary establishment.

It would appear that the grain sorghum stalk borer is spreading further south from the Springbok Flats, and it is appearing in growing numbers in the vicinity of Pretoria. Studies are now being carried out to develop suitable control measures.

COTTON

The present annual production of about 67 000 bales of cotton lint (229 kg each) is barely a quarter of the local industry's demand of 241 000 bales. Good foreign and local demand, coupled with reasonably good prices for cotton fibre, is expected to stimulate production.

Compared with the previous year's 30 000 bales, only 15 000 bales of seed cotton were produced in the *Lower Orange River area* (Gordonia Subregion) during the 1971/72 season. Labour problems are experienced in this subregion and in the South-Western Free State and

Griqualand West. In addition, cool rainy weather and high moisture conditions in the Griqualand West Subregion (Vaalharts and a few farms at Douglas and Barkly West) caused cotton bolls not to open and the micronaire to drop rapidly.

Overproduction of lucerne along the *Lower Orange River* has necessitated the planting of alternative crops. It was found that a wheat crop combined with a maize crop did not yield the same return as one good cotton crop, and there are indications that appreciably more cotton will be planted in the coming season.

In the *Karoo Region*, yields were much better than during the previous year, mainly because there was enough irrigation water. Better prices led to more interest being shown in this crop, but, owing to a labour shortage, the area planted did not increase much. The most important production area is the Lower Fish River Valley.

Cotton production in the *Barberton* district and the area surrounding it expanded and about 1 400 ha was planted. According to the local cotton co-operative, this year's crop is double that of last year — the result of larger plantings and better practices by the few large producers, and not so much of greater interest among local farmers. The yield was good, but the higher rainfall and frequent overcast conditions resulted in a disappointing fibre quality.

On completion of the 1971/72 trials at the Barberton Research Station, the research instruments and implements there will be moved to the Loskop Experimental Farm at Groblersdal, where research is carried out on cotton, wheat and groundnuts.

Cotton plantings at Groblersdal, Letaba and Rust de Winter were extended, but plantings of the crop in other areas were either abandoned or sharply reduced, mainly because of the labour shortage and the excessive cost of insect control.

Planting methods

At the Barberton Research Station it was determined that spacing in the row has little influence on the yield and fibre characteristics of cotton on dryland. The planting date influences yield, boll size, earliness of the crop and plant size.

A consideration of the factors of fertilising, cultivars and spacing shows that fertilising does not influence the yield very much and that differences between cultivars are more prominent. Albar produces a yield 45 per cent higher than that of Cape Acala, and Carolina Queen surpasses Cape Acala by 37 per cent.

It was also found that denser spacing usually produced bigger yields.

At Vaalharts, plantings with different plant populations were destroyed by hail shortly after emerging, and the fields had to be re-planted, towards the end of November. Because of the late planting date, the larger plant population did not, as in the previous year, produce a larger seed yield.

Crop rotation

In a crop rotation trial, cotton planted after maize, but with a fallow period in between, consistently produced the highest seed cotton yield. Good yields were also produced by cotton after groundnuts, and cotton after oats cut for hay. The poorest cotton yield was obtained from cotton in monoculture.

Fertilising

Fertilising trials were carried out on granite soil, red-brown sandy soil and sandy loam clay soil. In spite of a very good rainy season, the response, measured in terms of seed cotton yield was very limited. The average yield varied from 1 650 kg to 2 300 kg per ha.

At Vaalharts the first irrigations were carried out at 3, 6, 9 and 12 weeks after planting. The optimum yield was produced with irrigation at 6 weeks after planting.

The fibre percentage and micronaire values drop as the period before the first irrigation becomes longer, but there is no significant difference between irrigation at 3 weeks and irrigation at 6 weeks after planting.

Diseases and pests

Eelworm infestation is increasing at Vaalharts, and red bollworm and angular leaf spot were also severe this season. At Upington, red leaf disease is still the most important disease. Research on prevention has as yet produced no practical control measures, and producers are consequently wary of planting the crop. The recently released cultivar Acala SJ-1 is, however, much more resistant to red leaf disease than CA and ought to relieve this problem slightly.

For two consecutive seasons the available insecticides and methods of application were investigated at Rust de Winter. The results obtained now make it possible to offer producers advice.

At Barberton and Groblersdal good yields were produced where American bollworm was sprayed with endosulfan (Thiodan or Thionex) and red bollworm with carbaryl (Sevin).



Aerial spraying of cotton pests

Because of the high cost of spraying, almost no cotton is now grown on dryland in Natal although economic production is still possible where irrigation water is available. Seed cotton yields of 4 100 kg per ha were produced under irrigation at the Makatini research station.

Breeding and selection

As part of the programme at the Upington Research Station, six co-operative trials were planted along the Lower Orange River. In these experiments, two locally bred selections excelled. Both produced 12 per cent more seed cotton per ha than CA. Application has already been made to have these two selections included in the Department's Variety List.

The improvement of Albar 637 has advanced so far that a new Albar selection was included for registration in the list of cultivars during the past season. The application for registration of this selection has not been finalised, but it is more uniform than Albar 637,

and its fibre percentage is 2 to 3 per cent higher than that of Albar 637. It is also more resistant than Albar 637 to angular spot *Xanthomonas malvacearum*.

Other lines have been developed into uniform types by crossing, in-breeding and selection, and they have attractive characteristics, with a fibre yield 30 to 40 per cent higher than that of Albar 637.

Some of these lines have a shorter growth season than Albar 637 and are suited for cultivation under irrigation or on dryland at Bärberton.

In an experiment with the *growth-inhibitor* Cycocel (CCC) it was possible to restrict the height of cotton plants considerably by applying stronger concentrations of this inhibitor. On control plots, cotton plants reached a height of 150 cm, while the severest treatment restricted the plant height to 70 cm. Preliminary indications are that the yield is reduced as the amount of CCC is increased.

Imports and exports

As opposed to the 41,1 million kg last year, 30,5 million kg was imported under cover of 335 plant import permits this year, a reduction of 10,6 million kg.

50 100 kg of these imports was held back owing to the lack of moth-proof stores, and 64 600 kg was held back for fumigation, owing to the presence of excessive quantities of seed.

Most of the cotton, 22,7 million kg, was imported through Durban; East London and Cape Town were the second and third most important harbours.

GROUNDNUTS

A total of 63,9 million kg of groundnuts was exported under cover of 1 063 health certificates during the year under review, a decrease of 4,0 million kg compared with the previous year.

With the exception of 500 kg, all exports were handled by the Durban harbour.

In many regions producers experienced ever-increasing problems in finding enough labour, and it is, therefore, doubtful whether the rising trend in groundnut production can be maintained. This problem has also excited much interest in the possibilities of mechanical harvesting of this crop, and more than 100 lifter-pickers have already been bought (at a cost of more than R6 000 each). More and more provision is also being made for the artificial drying of groundnuts.

The South-Western Transvaal and the North-Western Free State and smaller plantings in the Bankenveld at present produce 45 to 50 per cent of the Republic's total crop and an appreciable increase in production, especially in the South-Western Transvaal, is expected. During the year under review, yields were, however, limited by abnormal rains, which also caused an increase in leaf spot. Two new cultivars, Selection 5 195 and Chimbaura, are gaining ground at the expense of the old standard cultivar, Natal Common.

Although the tremendous rise in the underground water table at Vaalharts had a marked effect on the crop, production in this area has remained reasonably constant during the past ten years, and fluctuated between the highest production of the decade of 280 000 bags in 1963/64 and the lowest production of 163 417 bags in 1969/70.

Groundnuts are considered a promising crop for irrigation districts in the Eastern Cape Region, especially the new areas under the Orange-Fish Scheme. In cultivar

trials at Alice and Qamata the cultivar 65 G119 did best, yielding 3 244 kg of unshelled groundnuts at Alice and 4 143 at Qamata.

Although the cultivation of groundnuts is an economic proposition in Northern Natal, farmers shy away from it on account of labour and harvesting problems.

On the sandy soil of the Makatini Research Station, a yield of 3 500 kg of shelled groundnuts per hectare was produced under irrigation.

In the Northern- and the North-Western Transvaal, groundnuts are one of the most successful crops under dryland cultivation, but scarcity of labour limits plantings, and groundnuts are grown only on the most suitable soil. Owing to smaller plantings and heavy, late rains, a drop of 25 per cent in production and a poorer quality crop are expected in the Central Transvaal Region.

Breeding and selection

Results obtained in the Highveld Region's breeding programme for improved Natal Common and large-kernelled types promise an improvement in the near future. During the past season, the progeny of the single-plant selections showed that there is a large measure of variability in the existing lines and cultivars that can be used for the isolation of improved types. In Potchefstroom such progeny of Natal Common types produced better yields and grading qualities than Selection 5. At Vaalharts selections from long-kernelled strains produced the same and higher yields with kernel counts of up to 32 per ounce.

In the past season, 275 single plants were selected for progeny trials at Potchefstroom and Vaalharts. In the glasshouse 254 crosses were made in 29 new parent combinations.

Diseases and pests

The sucking insect *Hilda patruelis* and the associated ant *Anoplolepis steingroeveri* are still a serious problem in the Ellisras area. At Bronkhorstspuit a producer stopped production owing to serious problems with the eelworm *M. hapia*.

In the Transvaal Region, ground weevils of the genus *Protostrophus*, 66 species of which occur over a wide area in the region, did the most damage to groundnuts and other crops in sandy and loam soils. Rosette and root rot were severe, especially in the Northern Transvaal.

Leaf spot and blotch were particularly severe at Vaalharts, where control was made difficult owing to

the high humidity following good rains. Farmers who started spraying early, however, obtained good crops.

Harvesting

In the Free State Region three farmers have started mechanising the harvesting process, but many problems are still experienced in drying the pods. In the Highveld Region no noteworthy progress has been made in this regard, and most groundnuts are still ploughed out, packed in cocks and later picked and shelled.

SUNFLOWER

Interest in sunflower production is steadily increasing, and this is being encouraged by the oil expressing industry. The change in policy with regard to yellow margarine has resulted in a great increase in the consumption of vegetable oils, especially sunflower oils, but the lack of a cultivar with a high yield potential and high oil-content for use in the South-Eastern Transvaal is still a serious deficiency.

Interest is further stimulated by the overproduction of other crops and by trials that have shown that this crop can compete economically with maize.

Production is increasing throughout the Highveld Region, and seed sales have increased in the five years from 1967/68 to 1971/72 from 1 050 bags (of 50 kg each) to 25 200 bags. Production rose from more or less 17 000 metric tons in 1970/71 to an expected 25 000 metric tons in the year under review. The growing interest is primarily attributed to the higher prices paid for the new high-in-oil cultivars.

In Northern Natal there is also growing interest in the cultivation of this crop, and in the Karoo Region it is expected that the area under sunflower, especially in the Fish River Valley, will increase considerably.

In the Free State Region sunflower plantings were smaller than in previous years.

There are indications that farmers on the Springbok Flats wish to make this their main crop.

The sunflower breeding programme is still at a very early stage but results obtained this year indicate considerable possibilities for improvement, especially as far as oil content is concerned. In the case of single plants selected from a group of high-in-oil cultivars, this content varied from 29 per cent to 52 per cent.

A programme for the eventual production of hybrid seed has already been launched.

In conjunction with the sunflower programme in France, plants of material supplied from France were made at Potchefstroom, while a number of hybrids from Rumania and one from Holland were also established in a trial.

Without lime, but with fixed applications of nitrogen, phosphate and sodium, sunflower produced about 2 000 kg of seed per ha with plant populations of 30 000 to 60 000 per ha. Where the plant population exceeded 60 000 per ha, the yield decreased, and with a plant population of 210 000 per ha, it was only 60 per cent of the above figures.

The planting pattern for populations of 30 000 to 60 000 did not influence the yield very much where the spacing was 30 cm between the rows and 32 cm in the row. However, varieties reacted differently to the various planting patterns. Early plantings from October to November generally produced better yields than later plantings from December to January.

In the absence of lime there is a tendency for nitrogen to depress yields of sunflower when amounts in excess of 30 kg of nitrogen per ha are applied in the presence of 25 kg of phosphate per ha or less. Where 50 kg of phosphate per ha were applied yields increased with nitrogen additions up to 60 kg of nitrogen per ha. Yields increased progressively with increasing rates of phosphate up to 50 kg per ha.

Potassium did not appear to affect yields on the Msinga soil series on which the trial was conducted.

Zinc in the presence of sulphur and absence of magnesium sulphate increased yields. In the presence of magnesium sulphate and sulphur, yields were depressed by zinc.

In the absence of sulphur and boron, molybdenum depressed yields where boron was applied, but not where boron was absent. Boron itself increased yields. Where sulphur was applied molybdenum decreased yields irrespective of boron applications. Boron itself increased yields.

Similar actions and interactions were obtained between various elements added. Balance between nutrients appears to be essential.

GUAR BEANS

Plantings of this crop in the Karoo Region initially showed promise, but owing to rain during the ripening of the bean, yields were low and of poor quality in the past season.

It is doubtful whether this crop can be cultivated with success in the Fish River Valley.

SOYA BEANS

High costs and insufficient inland availability of fishmeal compel feed manufacturers to look for alternative sources of crude protein. Most of the summer rainfall areas with an annual precipitation of more than 500 mm are suitable for the production of soya beans. The demand for soya beans can easily be satisfied, provided that the price ratio is favourable.

Although soya bean production is receiving attention in Northern Natal and Griqualand East, no dramatic increase in production is expected there in the near future, rather a gradually increasing interest.

In a dryland trial at the Döhne Research Station, a cultivar produced a yield of up to 2 458 kg per ha.

DRY BEANS

No particular change in the pattern of production is foreseen. The demand for small, white beans suitable for the canning industry cannot yet be supplied from local production, and production of the Michigan type of small white bean is becoming established mainly in the Bapsfontein district.

The breeding programme for the development of a bean cultivar for the canning industry is still at an early stage, but promising segregates have already been selected from the progeny of crosses.

Owing to the vulnerability of this crop to rust, drought and hail, the area under cultivation in the South-Eastern Transvaal is shrinking.

Dwarf bean types like Michigan Pea and Speckled Sugar produce better yields when planting distances are reduced from 90 cm by 12 cm to 30 cm by 8 (or 4) cm. The large, white kidney types do not do so well with closer spacings.

Thirteen different dry bean cultivars with two different planting dates were tested under irrigation at Vaalharts and the Sand-Vet. The highest yield — 2 355 kg per ha — was produced by the popular cultivar, Tepary. Other small, white-seeded cultivars such as White Dutch Princess, Small White Haricot and Bombust also fared well.

In spite of severe infection with bacterial leaf spot, the first planting (end of October) still produced a higher average yield than the second, uninfected planting (end of January).

CHICORY

Good results have been obtained with a number of precision planters that plant coated or pelleted chicory seed at predetermined spacings.

The small vegetable planter plants chicory seed densely and irregularly while the precision planters produce a more regular stand and this has led to the purchase of a number of precision planters.

However, if moisture conditions are not entirely favourable for germination, coated seed, which is expensive, causes problems. The possibility of planting uncoated seed with a precision planter is being investigated.

Stubby root remains a problem. Although the fungus *Fusarium oxysporum* is regularly associated with the disease, mechanical damage and eelworm may also play a part.

A black rot also seems to cause a great deal of damage to the crops. The fungus *Phoma exigua*, which also occurs in the Netherlands, has been isolated from big, black spots in the roots. The investigation of this disease is continuing.

Weeds are a great problem, particularly because the production area has a vigorous weed population and control is difficult during the early growth stages of the crop. Trials with new weedkillers that do the minimum of damage to the crop are giving promising results.

RICE

The annual production of rice in the Transvaal remained fairly constant at 2 500 tons, but production in Natal dropped to 200 tons. Total production amounts to only about 2 per cent of the consumption in South Africa.

In the Eastern Transvaal farmers have lost interest in growing this crop owing to the poor yields of previous years.

The chief cultivar planted is Blue Bonnet.

Some of the most promising weedkillers were compared and the preparation C 6989 (Prevoren) gave the best control of grasses and broad-leaved weeds, together with the highest grain yield. Other preparations such as CP 53619 and Planavin gave good control of weeds, but were phytotoxic.

In post-emergence sprayings Strain F-34 gave good control of broad-leaved weeds, with the exception of the wandering jew *Commelina benghalensis*. A product that

goes under the code name of BAS 3510 was used as a post-emergence weedkiller and gave good control over broad-leaved weeds and nutgrass.

Four cultivars were tested at the Outeniqua Experimental farm. On the basis of the results rice-growing in this area is not recommended.

SISAL

During the past ten years the annual production of sisal fibre rose from 1 350 tons to about 17 000 tons. About 85 per cent of this is supplied by White farmers, chiefly in Natal.

Since the local consumption is about 6 000 tons a year, there is a surplus, which has to be exported. The large-scale production and limited world demand have resulted in low prices which are expected to put a brake on production.

There were no new plantings on land owned by Whites in Natal.

PHORMIUM

The production of this bag fibre rose from about 270 tons in 1964 to about 4 600 tons during the past season. Production by White farmers (mostly in Natal) amounted to 1 350 tons.

Owing to the low profitability of the crop, production by White farmers will probably not increase further, despite the fact that quotas for 10 000 tons (from the total allocation of 20 000 tons) were granted to White farmers.

PYRETHRUM

Very little pyrethrum is grown in South Africa. The country's annual consumption is 400 tons as against a total production of only about 5 tons of dry flowers a year.

At present there is fairly keen interest in this crop, particularly in the Eastern Cape. Higher production is expected in future, on account of increased plantings in this area.

The biggest problem lies in obtaining suitable seed or planting material. There is also a need for better cultivars and research work on cultivars is being undertaken at the Döhne research station.

POTATOES

Foundation seed preservation scheme

During September 1971 a planting of two ha could be made with the yield from just less than one tenth of a hectare of virus-free foundation seed from the planting in 1970. This planting also did well in spite of continuous rain at the end of the growing season.

The first milestone in the existence of the scheme was reached when the Division of Pest Control could, during March 1972, hand over a total of 20 024 kg of virus-free foundation seed to the Potato Board for further multiplication. With this foundation seed the Potato Board intends making a multiplication planting of about 15 ha during August-September.

Sufficient foundation seed for the replanting of the foundation source was kept back. A further small replanting of the locally bred cultivars B.P.1 and Van der Plank will also be made. The foundation seed kept back for own use was successfully stored in a wire-mesh shed. An introduction phase for additional cultivars was also launched. On a lower plateau, about 4 miles from the foundation source, some new additions to the scheme will first be evaluated before being taken up in the foundation source. This will serve as an additional precautionary measure to prevent the possible virus infection of the foundation plantings.

In 1971, 1 975 470 kg of seed potatoes was imported, which was 5 148 582 kg less than was imported during the previous season.

The reasons for this decrease include the availability of large quantities of cold-storage seed potatoes with very good performance test results, the large price difference between the imported and local planting material, and more storage space that can be used to the full on account of larger plantings and higher yields.

These factors contributed to the fact that 92 per cent of the plantings in AA certificate regions during the past season consisted of locally multiplied, cold-storage seed potatoes, whereas imported seed formerly predominated.

Only Scotland, Ireland and New Zealand can comply with the requirements for the importation of seed potatoes, and these countries are at present the sole suppliers of seed potatoes to the Republic.

The following are some of the most important cultivars and quantities imported during the past season. (Imports of the previous season in brackets):

U.T.D. — 1,8 million kg (6 million kg)
Pentland Dell — 74 400 kg (103 200 kg)
Maris Peer — 49 100 kg (263 500 kg)

6 000 Kg of seed potatoes was destroyed during the past season, mainly owing to the occurrence of late blight and wet rot.

AA screening

Field screening

As against the 4 377 ha offered for certification during the previous season, 4 553 ha was accepted for certification during the year under review, an increase of 176 ha. Altogether 4 174 ha was planted with locally multiplied cold-stored seed, and 379 ha with imported seed. This large increase in the planting of locally multiplied seed can be ascribed to the fact that the South African seed is cheaper than the imported seed, that no differences in yield are noticed, that the two sources compare favourably as far as virus disease content is concerned, that certain diseases occur less in cold-stored seed and that a more homogeneous stand is obtained with this seed.

Where seed was rejected it was mainly on account of virus infection in neighbouring plantings, leaf roll and mosaic infection, mixing and weeds. Altogether 181 ha out of 4 553 ha was rejected. A reasonable quantity of the cultivar B.P.1, i.e. 230 ha, was planted in the AA regions for the first time.

Tuber inspections

Altogether 547 198 pockets (of 30 kg each) were offered for certification as against 364 344 the previous year. To a large extent this increase may be ascribed to larger plantings and favourable climatic conditions.

As a result of eelworm infestation, moth damage, *Rhizoctonia* infestation, brown scab infection and rotten tubers, 26 122 pockets out of the total offering were rejected this year.

A screening

Field screening

This year 4 676 ha was accepted for certification as against 5 372 ha the previous year. The only increase occurred in Natal, with a decrease in the Transvaal and the Eastern Free State.

Planting particulars for the various regions are as follows:

In the Transvaal and the Eastern Free State 2 403 ha, in the Western Cape 1 360 ha, in Natal 886 ha, and in the Karoo 27 ha of seed was planted, mainly B.P.1, U.T.D. and Van der Plank.

The South African-bred cultivar B.P.1 took over from U.T.D. as the most sought-after cultivar in these regions. The B.P.1 plantings show an increase of 178 ha, and U.T.D. a decrease of 62 ha.

Mainly as a result of leaf roll, mosaic, mixing and weeds, 188 ha was rejected.

Tuber inspections

Altogether 655 046 pockets (of 30 kg each) were offered for certification, an increase of 101 757 pockets over the previous year. The different A certificate regions offered the following quantities for certification:

Transvaal — 236 198 pockets
Eastern Free State — 952 pockets
Western Cape — 319 907 pockets
Natal — 94 123 pockets
Karoo — 3 866 pockets

Altogether 33 218 pockets were rejected, mainly on account of eelworm, rot, potato tuber moth and *Rhizoctonia*.

Production trends and problems

There was a considerable increase in the planting of potatoes in Natal, the North-Western and the Eastern Free State and the Eastern Province, with few changes in the other production areas. On the Transvaal Highveld good rains during the first half of the season, followed by a low rainfall during the latter half of the season, considerably reduced the crop.

The potato chip industry showed a tremendous growth rate during the past few years. The growth rate of this industry is about 15 per cent per annum.

The most important problems are the lack of cultivars with resistance to the most important diseases and pests, a shortage of suitable cultivars for industrial purposes, the disease-free maintenance of local cultivars and a lack of quality and keeping quality in potatoes from the Highveld and Natal.

A new problem, an imported one, is the so-called golden eelworm, which is capable of reducing yields by up to 70 per cent. With a proper crop rotation system this pest should not constitute as great a threat to the industry as was originally suspected.

Late blight caused large crop losses, at times as high as 60 per cent, in potatoes planted during the period December to February in the Free State.

Owing to eelworm and the high cost of fumigation, production is dropping in three Free State subregions, but in the Douglas ward the area under potatoes was increased by 25 per cent and about one third of the crop was kept back for planting.

Production is expanding in the Ermelo district and on the Middelburg Highveld. The Bon Accord area ($\frac{1}{2}$ a million pockets in the past) produced practically nothing on account of the occurrence of the golden eelworm.

The greater interest in the cultivation of cash crops in the Karoo Region resulted in larger areas being planted to potatoes, and fair to good yields were obtained.

Breeding and selection

The two South African-bred cultivars, B.P.1 and Van der Plank, are still the most sought-after South African cultivars.

Offerings for certification of these two cultivars were as follows:

B.P.1 — 2 495 ha
Van der Plank — 693 ha

In comparison with the previous year B.P.1 showed an increase of 5 ha and Van der Plank a decrease of 193 ha.

It is envisaged that these two cultivars will in future be planted on an even larger scale in the A certificate regions. A reasonable quantity of B.P.1, i.e. 230 ha, was planted for the first time in the AA certificate regions.

The following are some of the most important South African-bred cultivars offered for certification during the past season (Figures for the previous season in brackets).

B.P.1 — 2 495 ha (2 490 ha)
Van der Plank — 693 ha (886 ha)
Cedara — 124 ha (76 ha)
890/20 — 59 ha (143 ha)

About 60 000 seedlings were bred in the glass-house at the Research Station at Roodeplaat during the year under review. Five hundred new selections were made and about 50 strains have now advanced to the fifth year of evaluation.

In a cultivar trial planted at Rietvlei, 21 cultivars were compared. Well-known cultivars such as Up-to-Date, B.P.1, Van der Plank and Cedara were also included in the trial. Only the cultivars R100, Fanal, 69/2/24 and 69/2/25 are acceptable for chips as well as table potatoes.

In a cultivar trial at Ermelo the cultivars ND1, Elsa, Fanal and Ilam Hardy produced the highest yields of the 26 cultivars that were tested. The cultivar Ilam Hardy impressed because it produced a higher yield than well-known cultivars such as Up-to-Date, B.P.1, Van der Plank and Cedara. If the required qualities are taken into account, only the cultivars ND1, Fanal, Ilam Hardy and Elsa could be considered good cultivars.

In a field trial at Welgevallen, with 13 entries of cultivars for winter rainfall planting, 10 of the promising Canadian introductions were compared with controls. Five of these introductions did considerably better than King George and B.P.1, which are considered the best available winter cultivars. Owing to the drought, yield trials in the Sandveld could unfortunately not be continued.

However, the Canadian introductions were further multiplied in the Cold Bokkeveld during the summer. It appeared that some of these introductions are very sensitive to viruses, and it was consequently decided to continue with only four.

Two cultivars, LV.8 and Delaware, were compared for yield in a spring planting in the Winter Rainfall Region. Delaware disappointed and produced a yield of only 122 pockets (of 60 kg each) per ha of marketable potatoes. This was particularly so because the cultivars, in spite of preventive spraying, were found to be very susceptible to late blight *Phytophthora infestans*.

Even the yield of LV.8, 310 pockets per ha, was low in comparison with that of other cultivars. LV.8 might well have possibilities for the Region, but the cultivar Delaware is quite unsuited.

Planting methods

In a trial carried out at the Nootgedacht Research Station, the influence of four planting times (15 August, 15 September, 15 October, 15 November) on the yield and quality of four cultivars (Up-to-Date, B.P.1, Van der Plank and 890/20) was determined.

The past season's results show that Up-to-Date must be planted during August and B.P.1, Van der Plank and 890/20 between 1 September and 31 October if they are to produce high yields.

In a spacing trial at Nootgedacht, the influence of four different spacings (15 cm, 30 cm, 45 cm and 60

cm) on the yield of the same four cultivars was determined.

Results show that the optimum mass of seed for Up-to-Date and B.P.1 is about 3 metric tons per ha, while that for Van der Plank and 890/20 is between 3 and 6 metric tons per ha. If 90-gramme seed is planted, it means that the spacing for Up-to-Date and B.P.1 will be 1 metre between rows and 30 cm in the row. For Van der Plank and 890/20 it will be 1 metre between rows and 15 to 20 cm in the row.

Fertilising and crop rotation

In a project at Roodeplaat, where the fertilising needs of potatoes and the influence of fertilisers on certain quality characteristics of the tubers were investigated, it was found that, where more nitrogen than is needed for optimum yield is applied, tubers are inclined to sprout quickly after being harvested. Keeping quality is poor. Problems are also experienced with damage to the "skin" during harvesting.

Potatoes grown on leached out and acid soil with a low phosphate status usually produce problems with regard to quality if sufficient quantities of superphosphate are not applied. On these soils yields may be considerably increased and the keeping quality of tubers improved by applications of superphosphate.

Although applications of potassium show a slight or no influence on yield on most soils, favourable influences have in certain cases, usually on sandy soil, been achieved with potassium applications. A characteristically disadvantageous quality of potatoes produced on soil where there is a real lack of available potassium is that the tubers start sprouting quickly after being harvested. The keeping quality is then necessarily poor.

Although judicious applications of potassium will result in increased yields and a better quality in the above-mentioned case, excessive applications of potassium may reduce yields and lower the quality of the tubers.

In a pot trial at Roodeplaat it was found that the availability of oxygen to developing potato tubers at the ripening stage is most probably an important factor that influences yield and the quality of tubers. The provision of sufficient amounts of oxygen at the stage where tubers are growing fast, considerably increased the yield. Large tubers were obtained with a relatively high dry material content. The development of periderm was also stimulated by this condition so that tubers had thick, firm skins.

Where waterlogged conditions were artificially created in the tuber medium late in the growth period

by the application of carbon dioxide, the effects were damaging. A lower yield, small tubers with a low dry material content and thin "skins", were obtained.

Results obtained in field trials also indicate that a poorly aerated soil may have a harmful effect on the quality. Lower dry material content and more skin damage resulted from excessively earthing up potatoes.

Pot trials in glass-houses on the experimental farm of the University of Pretoria indicated that increased potassium feeding had a favourable influence on the general quality of potatoes. Yield was increased, tubers were larger, the dry material content of tubers was higher and the occurrence of internal brown spot was limited.

Diseases and pests

White blight (Oidium solani)

This disease was of importance only on potato winter production areas in the Transvaal. Spraying with sulphur-containing fungicides gave reasonably good control.

Late blight (Phytophthora infestans)

In spite of the good early rains on the Highveld late blight did not occur as early and severely as generally expected. The reason was that, in spite of good, regular precipitations, insufficient extended periods, which would have favoured the development and spread of blight spores, occurred. Blight occurred only in places from the beginning of December and was only established in most parts from the middle of December to the beginning of January.

The late blight forecasting service that was launched in 1969 for the Highveld and sent out only "broad" predictions in the first two years, is now becoming "refined". During the past season warnings were issued for specific regions and farmers were regularly informed of new incidences and the spread and severity of blight in the parts concerned.

Early blight (Alternaria solani)

Early blight was extremely severe on the Middleveld as well as on the Highveld during the past season, particularly on early plantings. Superficial symptoms were much the same as those of late blight, owing to the extremely severe and rapid infection of older potatoes. These serious infections, doing more damage than late blight, are ascribed to repeated heavy precipitations from early in the season and from the beginning of December. Spraying with various fungicides had little or no effect on the disease in most places.

Particularly heavy infections of early and late blight occurred in the Griqualand West subregion and did much damage to the crop. Sultry weather conditions made control difficult.

At the Outeniqua Research Station 9 different fungicides were used in the spring and 11 in autumn to control early blight and late blight infections in plantings of the cultivar King George. The trial was divided in two parts. One group was sprayed preventively regularly every ten days or after rain, and the other group only when the late blight infection was already 40 per cent.

With the preventive spring spraying the best yield (595 pockets of 60 kg of marketable tubers) was 108 per cent higher than that of the control, while the increase was 359 per cent in autumn.

The preparations that did best in spring were Antracol, followed by Dithane M45 and Dithane Z78. In autumn Antracol was best.

In the other group there was not one fungicide that could control late blight at such a late stage.

Fusarium

Except for storage rot, the diseases caused by species of this fungus occurred far less than during the 1970/71 season. Findings during that season, viz that the wilt disease can be controlled practically completely by controlling soil moisture, either by irrigation or by other means, were confirmed during the past season.

Trials carried out in various places, as well as observation of commercial plantings, showed that wilt disease was, almost without exception, absent in plantings (mainly early plantings) that received regular and good rains or irrigation from the beginning of the season. Plantings (mainly late plantings) that experienced drought periods during the season picked up the odd infection.

Jelly-end rot occurred relatively seldom, and this disease may to a large extent be limited by regular, thorough irrigation.

The trials revealed the following:

Of the four prominent cultivars in the Transvaal, viz 853/1, B.P.1, Up-to-Date and 890/20, the first-named was the most susceptible, followed by B.P.1, Up-to-Date and 890/20, with an increasing degree of resistance in the last-mentioned.

The following tillage practices and environmental factors increase the occurrence of the disease: large applications of nitrogen, wide spacing in the row as well

as between rows, the absence of certain trace elements in the soil or the plant, and light, sandy soils.

The incidence of the disease is reduced by: narrow spacing in and between the rows, high earthing up (30 cm), E.D.B. applications, leaf-feeding with certain trace elements, and reasonably deep planting (20 – 30 cm).

Trials in which the sprouting inhibitor Fusarex was tested for control of dry rot in stored potato seed, produced extremely promising results. This preparation not only countered dry rot very well, but also resulted in a significant increase in stand and yield in some trials.

Scab (Streptomyces scabies)

Except on very sandy soils, this disease was practically absent from early as well as late plantings on the Highveld. The reason was that regular, good rains during the first half of the season inhibited the disease to a certain extent, even in acid soils. This agrees with earlier findings that regular applications of moisture during the period from tuber formation until about two to four weeks later may reasonably effectively limit the infection of tubers. Infections picked up in sandy soils further confirmed these facts.

Skin spot and blind eyes (Oospora pustulans)

Since several producers on the Highveld are contemplating the cold-storage of seed potatoes, cold-storage trials were carried out at the Olko laboratory at Roodeplaat to study the possible occurrence and control of this disease under cold-storage conditions.

The trials showed that this disease is found under specific conditions and that particularly moisture is most probably the most important factor in the occurrence of the disease. It was found that seed potatoes of most cultivars could be stored at temperatures even as low as 2°C without any infection as long as humidity in the cold rooms is relatively low.

If humidity is too high, the disease occurs with *Pythium* rot, even on tubers treated with a fungicide.

Blackleg (Erwinia phytophthora)

After the sporadic occurrence of blackleg during the 1970/71 season, the disease, together with *Rhizoctonia* stem rot was completely absent from irrigation plantings of the very susceptible cultivar Up-to-Date, which illustrates the changeability and poor adaptability of the disease to general South African conditions.

Root rot (Pseudomonas solanacearum)

This dangerous disease occurred at a number of places in the Transvaal.

A tuber disease with unknown symptoms was found to be severe in some plantings. Bacteria closely related to the above were isolated in infected tubers. At present little is known about this disease complex.

Leaf roll

Very few tuber infections (secondary) occurred during the past season. During the most recent season conditions were ideal for the development of plant lice populations at the beginning of the season with further ideal conditions for the spread of the lice and consequent virus infection towards the end of the season.

A large percentage of the seed plantings in the Highveld, particularly late plantings, were rejected at the end of the season as a result of excessively high plant lice infestations in plantings. Definite proof was found that plant lice have started building up resistance to most of the prescribed insecticides.

Trials in which *inter alia* the effectiveness and the duration of protection of systemic insecticides were evaluated, revealed a very interesting phenomenon: it was found that the incidence of leaf roll, although still low, was higher on plots that were sprayed with systemic insecticides at the end of the season than on those plots that were not sprayed at all.

Internal brown spot

Of the four cultivars, 853/1, B.P.1, Up-to-Date and 890/20, the last-mentioned was far and away the most susceptible to this disease during the past season, while 853/1 picked up the disease far less. In B.P.1 and Up-to-Date the infection was moderate, B.P.1 being slightly more infected.

Low fertilising levels (particularly in the case of the cultivar Up-to-Date), large applications of potash, clean cultivation between rows, wide espacements in and between rows, sandy soils, shallow plantings and dry conditions promote this disease.

In well-fertilised soils, in late plantings, with narrow spacings in and between rows, in fields where no weed control is applied, in loam soils, under irrigation and with deep planting, the disease occurs less.

The incidence of internal brown spot was investigated in pot trials in glass-houses on the experimental farm of the University of Pretoria. Low

levels of potassium led to a larger degree of damage than high levels. This is ascribed to the fact that the characteristics of cell walls are adversely affected when calcium deficiencies occur.

Boron also had a slight effect, possibly also on account of some influence on the characteristics of cell walls. Some connection was found between the incidence of internal brown spot and the degree of skin bursting. Both phenomena were intensified by high soil temperatures and a well-aerated tuber medium, apparently owing to the incidence of thicker periderms in these conditions.

Chlorogenic acid is most probably responsible for the development of the colour in internal brown spot, but the condition is not primarily caused by a high concentration of chlorogenic acid.

Hollow heart

This disease occurred very sporadically, chiefly owing to the changeability in the climate, particularly rainfall, in the various potato-producing areas. In some parts hollow heart was no problem at all, while farmers in other areas, for instance at Amsterdam and Middelburg (Transvaal), just could not market large potatoes owing to the extremely high incidence of the disease.

The deviant phenomenon of the 1970/71 season, when the disease occurred a lot on the cultivar 853/1, was not repeated in the past season. Hollow heart followed the same pattern as internal brown spot, viz the cultivar 890/20 was affected most, followed by B.P.1 and Up-to-Date, 853/1 being least affected.

The close correlation between this disease and internal brown spot in respect of some factors was particularly noticeable in trial plantings. Wide spacings in rows, shallow plantings, periods of drought and clean cultivation promote this disease, while it occurs less in late plantings, with narrow spacings in and between rows, in fields where no weed control is applied, under irrigation and with deep planting.

Eelworms

Root-knot eelworm, but particularly skin eelworm *Pratylenchus* spp., occurred little or not at all in the potato-producing parts of the Highveld.

Potato tuber moth (Phthorimaea operculella)

Compared with the previous season, damage to tubers by the potato tuber moth larva was not so severe, particularly in the parts where biological control by means of the imported wasps was already established. In

contrast with observations during the previous season, tuber damage was far less in 853/1 than in B.P.1, Up-to-Date and 890/20.

Trials showed that more nitrogen fertilising resulted in significantly greater tuber damage. It was further found that wider spacings in the rows, as well as shallow plantings, show a larger percentage of tuber damage. The disease is less prominent in sandy soils, and is to a certain extent reduced by clean cultivation, but is controlled most effectively by high earthing up.

Potato beetle (Epilachna dregei)

This beetle caused limited damage to potato plants in the vicinity of Brits.

Plant lice as carriers of leaf roll virus in seed-potato production

The green peach aphid *Myzus persicae* is the biggest single problem in the production of virus-free seed potatoes in the Cold Bokkeveld. Existing control programmes, which account for one-fifth of the total production costs of seed potatoes, contain errors, particularly in respect of the relative importance of soil systemic preparations such as disulfoton and above-ground applications of preparations such as demetonmethyl. This problem is being further investigated.

Weed control

A survey of the extent of nutgrass damage in potato tubers produced disquieting figures. It was found that cultivars with short growing seasons, such as 853/1, that are left in the soil for a long time after ripening suffer up to 20 per cent or more damage.

Trials showed that nutgrass can be controlled with a reasonable measure of success by, where possible, planting potatoes relatively late, earthing the rows up high, applying clean cultivation in lands, planting relatively deep, covering rows with straw or something similar at the end of the season or not leaving potatoes in the soil for too long after ripening.

Nutgrass is more of a problem in heavier than in sandy soils.

Production of leaf tobacco in million kg

Year	Flue-cured	Light air-cured	Burley	Dark air-cured	Turkish	Total
1967/68	10,31	4,10	1,00	10,09	0,59	26,09
1968/69	20,33	4,50	1,38	9,32	0,87	36,40
1969/70	20,16	3,87	1,67	9,91	0,74	36,35
1970/71	19,65	2,91	0,72	9,19	0,59	33,06
1971/72	17,84	2,91	1,11	8,67	0,77	31,30
(Estimated)						

Cold-storage

The cold-storage of seed potatoes has now developed into an established practice. Two co-operatives have already erected their own cold rooms. It is estimated that there were more than 350 000 x 30 kg seed potatoes in cold-storage during the past year.

The treatment of cold-stored seed potatoes after removal from the cold rooms is very important. Seed potatoes planted immediately after cold-storage germinate very poorly. High temperatures after cold-storage are also undesirable. It would seem to be the best treatment to keep cold-stored seed potatoes at 20°C to 25°C for two weeks and then to plant them.

Temperatures higher than 30°C are most disadvantageous for cold-stored seed potatoes and the longer the delay in planting cold-stored seed potatoes after removal from the cold rooms, the poorer their germination. It was found that cold-stored seed potatoes should not be planted immediately. But if there is a delay of more than 30 days before planting, the germinating capacity quickly decreases.

TOBACCO

Production trends

After the two successive record tobacco crops of 1968/69 and 1969/70, production has now declined for the second year in succession. The decline affected mainly flue-cured and light air-cured tobacco while Burley tobacco production increased slightly. Although the decline in production was the result mainly of climatic factors, smaller plantings were also partly responsible.

The increasing labour problems and rising production costs have forced producers in certain tobacco-growing areas to curtail production.

The following table contains production data for the past five years:



A bulk curing oven. The use of this technique results in appreciable savings in labour

Good rains during the past season made the production prospects for the 1972/73 season very favourable, since the reservoirs in the main production areas have enough water. The increases in the minimum selling prices of flue-cured, light air-cured and dark air-cured tobacco should stimulate production.

Exports declined for the second year in succession, and have now dropped from 13 098 million kg in 1969 to 10 782 million kg in 1971. This decrease was the result of shortages.

Imports – Altogether 41 200 kg of tobacco was imported under cover of eight import permits during the year under review. This was 128 200 kg less than the previous year.

Major problems

The most important persistent problems in the tobacco industry are the rising production costs, higher wages and a shortage of labour. These problems are becoming more and more critical as agriculture begins to be affected by competition from decentralised industries.

The disease problem in tobacco is still complicated, because of the nature of the final product. Because there are no measures to control diseases such as black shank, brown spot, angular leaf spot, wildfire and mosaic, the attention has to be concentrated on a breeding programme.

Research

So far as the nutrition of tobacco is concerned, nitrogen is, because of the very critical nutritional requirements of tobacco, undoubtedly responsible for a large percentage of the poor-quality tobacco produced annually. A new series of projects was registered to study nitrogen nutrition of tobacco.

The research programme at the Tobacco Research Institute will derive benefit from a commercial glasshouse that is rapidly nearing completion.

Breeding and selection

The sole purpose of all research projects relating to breeding and selection is still to develop highly productive, disease-resistant cultivars yielding tobacco of an acceptable quality, for release to the industry.

Flue-cured tobacco – Of all the diseases, black shank is still the most important potential menace. Two flue-cured cultivars that are apparently resistant only to one of the various strains of black shank, have already been released with great success. The Agronomy Section is carrying out an uninterrupted breeding programme, and black shank resistance is receiving special attention. The two cultivars mentioned above are also resistant to powdery mildew and mosaic.

Promising results were obtained from some of the 25 cultivars tested this year, and most of these cultivars

are also resistant to powdery mildew, mosaic and black shank.

Results of breeding value determinations showed further that highly productive strains resistant to these three diseases could be obtained. There were indications of a significant variation in the susceptibility of the cultivars to angular leaf spot.

Burley tobacco — Forty-nine Burley strains were planted, most of which are resistant to powdery mildew, mosaic and black shank. There were great differences in yield, value and chemical composition. A number of strains will be included in a cultivar trial, and their release for cultivation will be considered.

Air-cured tobacco — Breeding programmes for light air-cured and dark air-cured tobacco also yielded promising results. Various strains resistant to powdery mildew and mosaic were included in cultivar trials, and their value and mass yields compared very favourably with those of existing cultivars. Release of these cultivars is being considered.

Turkish tobacco — The Turkish tobacco cultivar Elcatra, which is resistant to mosaic and gave promising results in cultivar trials last season, will be available to producers in the next season.

Nematode resistance — Good progress was also made with breeding for resistance to nematode infestation. This is a slow process, but certain tolerant lines are already tending to produce tobacco that satisfies certain of the requirements for an acceptable leaf.

Planting methods

Flue-cured tobacco — In contrast with the results obtained during earlier seasons, there was no difference between flue-cured tobacco grown in rows 90 cm apart and tobacco grown in rows 100 cm apart, but both these spacings gave better results than rows 120 cm apart. Results obtained with flue-cured tobacco again proved that plants topped and spaced to produce about 400 000 leaves per hectare gave the best value and mass yield.

Burley tobacco — In the case of Burley tobacco the cultivars M30, B49 and B21 gave the highest value, and mass yields when they were topped and spaced to produce about 500 000 leaves per hectare.

Air-cured tobacco — Trials with dark air-cured tobacco showed clearly that the spacings that favour the production of tobacco of a lighter colour gave the best results in terms of value yield. The reason for this is the price differences between light and dark air-cured tobacco.

Fertilising

Fertilising studies deal mainly with nitrogen and phosphorus nutrition of tobacco, and with the investigation of the high chlorine content of tobacco in certain isolated production areas.

Nitrogen — Because the nitrogen requirements of flue-cured tobacco are very critical, attention was first given to times and levels of nitrogen application. This was the first season of the experiment, and it was immediately clear that it is extremely important to take climate, especially rainfall, into account in evaluating results.

Although it is generally accepted that all nitrogen should be applied as early as three to four weeks after transplantation, the results obtained this year showed that the best mass yield was obtained where all the nitrogen was applied only five weeks after transplantation.

Results relating to the effect of various ratios of $\text{NO}_3:\text{NH}_4$ in the nitrogen application showed that the poorest results were obtained where all the nitrogen was applied in either the NO_3 (nitrate) or the NH_4 (ammonium) form. A ratio of 75 N (NH_4):25 N (NO_3) gave the best mass yield.

Phosphorus — Final results of the phosphorus fertilising trials with tobacco, carried out on the same plots over the past eight years, proved that phosphorus applications can be drastically reduced on established tobacco lands where the fertilising programme has been relatively intensive.

Chlorine — The high chlorine content of tobacco in some production areas is still receiving attention. Surveys have shown that, in spite of good rains, the chlorine content of tobacco is still high in certain isolated areas. The dilution of the chlorine in the main irrigation dams ought to alleviate the condition considerably during the next season.

Cultural methods

Sucker control — Topping has various advantages in regard to the yield and quality of the tobacco. But topping results in suckers developing in the leaf axils, and this may have an adverse effect on yield and quality.

Chemical sucker control saves labour, and promising results have already been achieved with certain preparations. As soon as the research workers are satisfied that the residues of the preparations and the smoking characteristics of the tobacco satisfy the set requirements, it will be possible to register these preparations.



The artificial infestation of tobacco with angular leaf spot bacteria is a break-through of great importance in breeding resistant cultivars

Induced maturity — Research on inducing maturity in tobacco by applying Ethryl was continued. The data relating to losses of dry mass and the effect of the treatment on the chemical composition of the leaf necessitate further research before the real advantages of the treatment can be evaluated.

Diseases and pests

Black shank — Black shank, especially on the heavier soils, caused considerable damage during the past season even in two cultivars specifically bred for resistance to the disease. Closer investigation revealed that these two cultivars are still resistant to the strain of the black shank fungus against which they were originally tested. Their susceptibility to the disease this season can only be ascribed to the presence of other strains of the fungus.

A general survey on the presence of strains of this fungus in tobacco soils and a screening programme to detect resistance are progressing satisfactorily.

American bollworm — Lannate, the preparation registered during the past season for use against bollworm on tobacco, gave good control. Lannate is, however, too poisonous to use on fully grown tobacco, and Thiodan dust which, if it is applied correctly, also gives good control, had to be used again. An interesting observation that, after the tobacco has been topped the bollworm attacks mainly the young suckers that develop and does relatively little damage to the crop leaves, is being followed up.

Insects in stored tobacco — Damage done in stored tobacco by the cigarette beetle is still an important problem. Existing fumigants will not give wholly effective control before the sheds in which the tobacco is stored have been made air-proof. Results relating to the control of the beetle with Phosphine tablets indicated that the use of these tablets will be more effective and more economical than fumigating with methyl bromide.

Angular leaf spot — The high rainfall and favourable temperatures during the year under review were conducive to the infection of tobacco with bacterial angular leaf spot. It was established that a large percentage of the leaf spots previously diagnosed as so-called "weather spot" had, in fact, been caused by angular leaf spot bacteria. The development of a technique for the artificial infection of leaves with the bacteria was a break-through, and will be of especial value in the breeding programme aimed at developing resistance to the disease.

Weed control

Five weedkillers were applied and evaluated. No differences could be registered as regards plant properties and production. Planevin gave significantly better control of broad-leaved weeds than any of the other preparations, even up to eight weeks after transplantation of the tobacco. Planevin did not control nutgrass, but Tillam did.

In a series of pot trials at the Faculty of Agriculture of the University of Pretoria it was

established that the weedkiller Benefin retards tobacco root growth considerably. Even the normal, recommended concentrations may damage roots in sandy soil. The total mass of roots, total root length, the mass of fine roots and the aerial growth may be harmed by this preparation which will, therefore, have to be applied with great caution.

Harvesting methods and curing

Hail-damaged tobacco — Now that mosaic resistant cultivars have been released, the danger of mosaic-infection resulting from hail damage is something of the past. This has tremendous advantages for the producer, because the damaged tobacco can be cut off and may still produce a considerable crop through sucker growth.

Research on this subject has yielded extremely promising results. Cutting damaged tobacco mechanically using a silage cutter not only had labour-saving advantages over the practice of cutting the tobacco by hand, but also gave a better mass yield.

Whole-plant curing of Turkish tobacco — Labour-saving harvesting procedures are needed in the production of Turkish tobacco. Two cultivars were harvested by four different methods. It was repeatedly found that whole-plant curing gave a much lower yield than leaf curing. A remarkable increase in yield was registered where only the lowest third of the leaves were picked at maturity, and the rest of the plant was cured as a whole instead of the whole plant being cured when all the leaves were mature.

The experiments are being continued to establish whether the saving on labour brought about by whole-plant curing can compensate for the loss in mass yield in comparison with leaf curing.

Bulk curing of flue-cured tobacco — Provisional results obtained in earlier seasons indicated that a labour saving of 60 per cent was possible if the bulk-curing technique was applied. Controlled-time studies this year proved beyond doubt that a labour saving of 56 per cent could be effected in harvesting, filling and emptying the sheds and stacking the cured tobacco by bulk curing instead of using the conventional harvesting and curing methods. Small technical improvements to the loading frames will increase this figure to over 60 per cent.

Special attention was given to the curing schedule in bulk curing, and especially the effect it has on various properties of the cured product. These properties were compared with the properties of tobacco cured by the conventional method.

Promising results were obtained, and will soon be available in the form of a report. The main conclusion is

that, all in all, the value yield of bulk-cured tobacco per 100 kg of dry material harvested compares favourably with that of conventionally cured tobacco. The chemical composition satisfied the set requirements.

Quality studies

In developing new cultivars, it is important to know what correlation or relationship there is between the colour of the leaf, which is an important norm in the grading and valuing of tobacco, and the chemical composition and physical characteristics of the leaf. The chemical-physical characteristics are of great importance in ensuing consumer acceptability and certain standards have to be met in this connection. Linking colour to physical-chemical characteristics is not only of importance to the researcher, who will be enabled to make certain deductions about the identification of problems according to the colour of the leaf, but also for the industry which has to determine whether certain grades of tobacco are acceptable chemically and physically for manufacturing purposes.

A great deal of scientific evidence was produced that colour groups within a specific grade, but also from grade to grade, were related to certain physical characteristics, and even more to certain chemical characteristics of tobacco.

The work is being continued, and the relationship between leaf position on the stem, colour and physical-chemical characteristics will also be studied.

Soil and plant analyses

Because the results of chemical analyses are essential to the interpretation of experimental data in tobacco and to the identification of problems, this type of work is given priority. More than 8 000 samples were analysed for six different components. Quality interpretation of experimental material obtained from fertilising, cultivation and cultivar trials was facilitated considerably.

ARTIFICIAL PASTURES AND FORAGE CROPS

LUCERNE

Infection with bacterial wilt *Corynebacterium insidiosum* has become a serious problem on certain farms, chiefly in very old stands and fields that have not been adequately fertilised and irrigated.

The good progress made during the previous year in the Karoo Region with the improvement of lucerne

through breeding is being maintained. The four fully adjustable growth cabinets that were taken into use have proved very useful.

Dryland lucerne, which forms the basis of the artificial pastures in the South Coast area, has become somewhat suspect on account of the droughts of the past few seasons and the threat from *Corynebacterium insidiosum* and *Fusarium solani*. Since lucerne is very important in these areas, strains that are resistant to these diseases are now being tested at various places in co-operation with the Karoo Region.

Lucerne yield trials are being carried out in co-operation with the Karoo Region at Tygerhoek, Bredasdorp and Riversdale. Each trial consists of 16 entries, viz S.A. Standard, which serves as a control, and 15 cultivars and strains that are resistant to *C. insidiosum* and *F. solani*. The rainfall in the South Coast area was good during the year under review and the presence of these diseases could not be established in the trials.

In the absence of diseases none of the new strains and cultivars could beat the ordinary South African lucerne.

In *Griqualand West* lucerne remains one of the most important rotational crops, especially where vegetable crops and potatoes are grown. The value of lucerne in rotational cropping lies chiefly in its control of disease rather than in its effect on soil fertility.

Lucerne was established with great success on dryland at Hertzogville and excellent yields of 3½ tons of hay per ha were obtained.

Dryland lucerne established in April 1970 on a deep soil (Kinross series, Shortlands form) in the Free State Region, was cut for hay production during the first summer season (1970/71) and grazed by sheep during the past season (1971/72). The yield that the sheep grazed from this strip is calculated at about 3 700 kg of dry matter per ha.

It has been proved that dryland lucerne has possibilities as a perennial pasture crop for the Central and South Eastern Free State and that the crop is really very hardy. However, lucerne for hay production, should not be allowed to grow long in the hot, dry periods but should be kept short by grazing and allowed to grow long only during the relatively cool, damp periods.

This crop also kept wind erosion at a minimum.

Dryland lucerne is being planted to an increasing extent in the North-Western Free State and yields of up to 6 tons per hectare are easily obtained. A lot of lucerne is also grown under irrigation along rivers.

CLOVER

With legumes problems resulting from excessive soil acidity often crop up with inoculation. At Tygerhoek the benefit of lime applied to raise the pH was evident. Apparently fairly small applications of lime are needed for the successful inoculation of *Medicago truncatula*, *Trifolium subterraneum* and *T. hirtum* on the acid shaly soils of the Swartland and the South Coast area. Findings indicate that the relatively low aluminium content of these soils is probably responsible.

In the South Coast area it is common practice to establish pastures with wheat. The reciprocal effect of the cereal and the undersown pasture crop, lucerne, *M. truncatula*, rose clover *T. hirtum* and Merridin rye grass were investigated in field trials at Tygerhoek and Bredasdorp. It is clear that the seeding density of the wheat had a greater effect on the yield than the presence of the undersown crop. It can be deduced from the wheat yields that the rye grass competed more keenly with the wheat than the legumes did and that lucerne was somewhat more of a competitor than the annual legumes.

Successful establishment of clover in the veld in the Natal Region has been achieved by means of both the Cedara sod-seeder and Contra-seeder. Results to date stress the importance of applying adequate phosphate which must be placed so that it is available to the plant from seedling stage.

OTHER FORAGE CROPS

Eragrostis

In the moist, tall grassveld of Natal *Eragrostis curvula* produced up to 13 tons of dry matter per ha on a deep red soil and 11 tons per ha on a poor duplex (claypan) soil. Results over several seasons have indicated that *Eragrostis* could play an important role as a cash crop in this area.

The high yields obtained from *E. curvula* at both the Kokstad and Dundee Research Stations have demonstrated the potential of this grass. Notable features of this species include:

Its response to high fertility, especially N and P;

Its ability to establish rapidly and yield well in the season following autumn planting;

Its ability to compete successfully with weeds

Its good hay qualities;

Its adaptability to a wide range of soil and climatic conditions; and

Its high production potential if well managed.

Row planting or drilling of the seed is preferred to broadcasting.

The effect of various fertilisers on the yield response of *Eragrostis curvula* was determined over a period of six years on the Rietvlei soil series of the Bethlehem Research Station. Experimental findings were that the optimum level of nitrogen fertiliser for *E. curvula* was higher than 168 kg of N per ha, applied in the form of urea. The application of 28 kg of P per ha (superphosphate) produced better hay yields than applications of 14 kg of P a year.

Plots that were not limed when they were established produced better hay yields on the average than plots that received 4,2 mg of agricultural lime per ha. The yield response of the *E. curvula* that received 28 kg of P per ha was significantly reduced by the application of agricultural lime.

Further experimental data gathered at Bethlehem over a period of six years show that seeding densities of 1,0, 2,0 and 3,0 kg of *Eragrostis curvula* seed (Ermelo type) per ha produced no differences in hay yields. However, trials with various spacings show that 91-cm rows produce better hay yields than broadcast establishment, but the latter maintains better production than 18-cm and 14-cm spacings. The hay production was significantly better throughout with fertiliser applications of 28 kg of P per ha (superphosphate) plus 106 kg of N per ha (urea) a year than 14 kg of P per ha plus 53 kg of N per ha a year.

During the past year old land grass became more popular than ever before on the softer, sandier soils north of Bethal. Exceptionally high yields of 10 tons of hay per ha were obtained where the grass was well fertilised.

Forage sorghums

During the 1971/72 summer season the forage sorghum hybrid Trudan II was planted on dryland at Glen. The sorghum was grazed by sheep at various stages of growth and it was found that this annual hybrid has great potential as a source of green pasture during summer. It recovers exceptionally well after grazing, even at an advanced stage of growth, and stands up to hot dry periods exceptionally well, even when growing in dense stands and at an advanced stage of growth.

Very good utilisation by sheep has been observed. In one camp a total dry matter yield of up to 7 000 kg per ha was taken in by the sheep.

Blue buffalo grass

Although there is a tendency in the Bechuanaland Subregion to plant more and more forage crops on account of the drought of the past few years, the area under perennial grazing crops in the Central Free State has dropped considerably. Farmers are concentrating on growing annual sorghums and annual pasture crops such as babala, oats and wheat, and the feeding of dried maize and sorghum hay in ground form is increasing.

Blue buffalo grass *Cenchrus ciliaris* is rapidly gaining ground in the Bechuanaland Subregion, since the problems connected with establishment have largely been solved.

Kikuyu *Pennisetum clandestinum*

Kikuyu seed found at Nooitgedacht in January 1971 showed 60 to 80 per cent germination. A pot trial was laid out to determine germination at optimal sowing depths.

A small paddock with very poor soil was sown in December 1971 and germination seems promising. Preliminary results obtained with kikuyu that had been killed by frost indicate its potential as winter pasture. An equivalent of eight sheep per hectare was carried for 100 days on kikuyu that had been killed by frost.

Heifers gained 1,3 kg a day during the first week and 0,6 kg during the second week. Sheep gained 0,71 kg a day for the first week but after 33 days their mass gain dropped to 0,04 kg a day.

Nile grass *Acroceras macrum*

This promising species, previously thought to be non-seeding, has in fact been found to be free-seeding. Seed germination, while being extremely low immediately after harvest, increases appreciably (up to 32 per cent) after ten months of storage. Removal of the palea and lemma of fresh seed results in germination percentages of up to 78 per cent.

On the basis of morphological characters (e.g. growth habit, leafiness, fertility) and disease resistance (smut and leaf spot) 69 superior progeny have been selected.

Italian ryegrass

Further evaluation of locally bred diploid selections has revealed that two are significantly superior in yield to all seven diploid commercial varieties tested.

Columbus grass (*Sorghum alnum*) is the most important fodder sorghum in the Bechuanaland Subregion and is preferred to babala. It is perennial, tasty and exceptionally suitable for lands subject to wind erosion



A nice stand of blue buffalo grass (*Cenchrus ciliaris*) in its first year after establishment in the Vryburg district



Legumes

Research in the coastal area between Port Alfred and the Kei River has demonstrated that subtropical grass-legume pastures are likely to play an important role in this area. Over the past years dry matter production of these pastures was approximately fourfold that of veld and tenfold that of exhausted old pineapple lands.

The three most promising legumes are siratro *Phaseolus atropurpureus*, greenleaf desmodium *Desmodium intortum* and *Glycine wightii*. These legumes combined well with grasses such as Rhodes *Chloris gayana*, blue buffalo grass *Cenchrus ciliaris*, *Panicums* and *Setarias*.

Lotononis bainesii has done exceptionally well on a poorly drained duplex soil in the tall grassveld of Natal. The species is very promising for veld reinforcement and for establishing in cultivated pastures.

Trials indicate that tropical legumes may play an important role in the development of economic pastures in the tall grassveld and sandy sourveld of Natal. Particularly promising species are siratro, desmodiums, lotononis, stylo and glycine.

A mixed pasture of silverleaf desmodium and Nile grass produced 7,4 tons of dry matter per ha during the 1971/72 season in a trial at the De Hoek Research Station near Estcourt.

Yield trials with annual grass-legume pastures were again carried out at Langgewens, Tygerhoek and Bredasdorp. *Medicago tornata*, which was tested for the first time in the yield trials, did very well under the dry conditions.

In spite of the drought good results were also obtained in a yield trial with vetches. Eight cultivars were compared and the early types from Western Australia, viz Nyabing, Lanquedoc and Swartland (a local name), did exceptionally well as far as hay yield and seed crops go.

In the yield trial at Bredasdorp various cultivars of rose clover *Trifolium hirtum*, yamina *T. cherleri*, *T. clypeatum* and Woogenellup subterranean clover did best.

Demonstration plots of 20 species of indigenous forage herbs were planted to test adaptability. Certain species of bietou *Osteospermum sinuatum* and cancer bush *Sutherlandia frutescens* grow very well and seem promising as far as edible matter goes.

According to observations bietou seed germinates well, even when moisture conditions are minimal.

Oats (Saia), an annual ryegrass (Billion) and two rye varieties (Wrens Abruzzi and *Secale cereale*) were compared in a trial with regard to the seasonal production of green matter over five cuttings.

The annual ryegrass (Billion) produced the highest yield of green matter (44,86 tons per ha), which was significantly superior to Wrens Abruzzi (32,66 tons per ha) and Saia oats (30,27 tons per ha), but not significantly superior to the strain of *Secale cereale*, which yielded 41,92 tons per ha.

DROUGHT FORAGE CROPS

Spineless cactus

Sustained interest in the planting of spineless cactus is still observed. The participation of farmers in the Stock Reduction Scheme is partly responsible for the fact that many of the poorer areas that are being withdrawn from grazing are now planted to spineless cactus and other drought forage crops, since the stock cannot damage the new plantings.

Cases of severe outbreaks of cactoblastis in spineless cactus again occurred during the past year. Apparently where cocheneal-resistant blue-leaf spineless cactus cultivars were attacked by cocheneal, the cactus had been too severely grazed or cut, so that the new growth was damaged by the cocheneal.

The discovery that cocheneal and cactoblastis (egg cases) may be effectively controlled by timely spraying

with carbaryl should be of great value in the campaign against these insects.

Good progress is being made with the development of new spineless cactus cultivars through breeding and selection. The evaluation trials with breeding material as well as local and imported material are progressing well.

At the Oudtshoorn Experimental Farm the three blue-leaf cactus cultivars received no irrigation, but Chico, Robusta and Monterey nevertheless grew very vigorously.

Although all three cultivars are subject to cocheneal infestation, Monterey appears to be the most vulnerable. However, good control of cocheneal was established by means of spraying with carbaryl.

Further field experiments demonstrated the effectiveness of two insecticides for the control of *Cactoblastis cactorum* and cocheneal infestations of spineless cactus. A single application of either insecticide, properly timed and applied correctly, gives economic control of the insects.

Saltbush

The great interest in the planting of old-man saltbush *Atriplex nummularia* continued and the demand for seed was so great that it could only be satisfied by limiting the quantity issued to 500 g per farmer.

Various farmers have already had great success with the planting of old-man saltbush. A farmer in the Jansenville district is at present busy establishing about 200 hectares of useless old land under saltbush.

It also became clear that saltbush can be successfully used for the reclamation of unproductive veld and bare patches.

Good progress is being made with the improvement of old-man saltbush by breeding and selection. The salt content of the plants appears to have very little, or no, effect on palatability.

The grazing trials with sheep on the saltbush introductions from the world collection have been completed and good results obtained. *Atriplex canescens* appears to be the most promising because its palatability and height are more consistent. It should do very well as a drought forage crop, especially in the warmer parts of the Karoo Region. *Atriplex breweri* is better adapted to the colder parts.

Australian bluebush

This plant was multiplied at Neudam and made available to farmers. A few thousand young plants were planted in the veld and have become well established.

5. Horticulture

DECIDUOUS FRUIT

WINTER RAINFALL AREA

The production of apples and pears is expected to increase rapidly during the next few years, but the production of clingstone peaches, apricots and plums show a downward trend. Disappointing overseas prices for some pear, apple and plum cultivars will probably lead to these cultivars being replaced by more sought-after ones.

Problems are being experienced with the marketing of the most important kinds of fruit and producers are at present investigating the production of replacement products such as berries and strawberries. The high cost of transporting these by air, however, is a problem.

Problems

The appearance of the European red mite, although limited, will lead to increased production costs, in spite of measures to check its spread because this pest requires a control programme differing from the existing one.

Last year fusicladium for the first time caused considerable damage to cold-stored apples from the Langkloof. This was the case with locally stored apples as well as consignments that were exported.

Bacteriological canker had always been considered the only serious disease related to die-back of apricots, but it was recently established that a fungus *Eutypa armeniaceae* is responsible for the disease in the case of older apricot trees.

Bacteriological canker in all stone fruit was previously ascribed to *Pseudomonas syringae*, but recent isolations from plums and cherries with symptoms of bacteriological canker brought to light an organism with the same characteristics as *Pseudomonas morsprunorum*. In the case of apricots and peaches the causal organism, however, was still *Ps. syringae*.

New research programmes

The great variation between trees, which occurs in orchards on seedling rootstocks, has led to preference being given to clone rootstocks that can be propagated vegetatively. Since more and more rootstocks are becoming available, rootstocks are at present receiving

intensive attention, and quite a number of plantings have been made to test rootstocks for apples, pears, peaches, plums and apricots.

Under present conditions of rising production costs and increasing problems with marketing, healthy, true-to-type trees with a high productivity are a prerequisite. A selection programme is at present in progress to obtain the most suitable material for the propagation of every cultivar. This programme forms an important part of the Department's contribution to a plant improvement scheme that is envisaged for the industry.

The industry's progress is still being limited by a shortage of suitable cultivars, and the importation of cultivars that might possibly do well here enjoys high priority. Since cultivars from reliable sources are now being released to research institutes under open quarantine, testing can start and be completed much sooner than before.

Marketing

In general, marketing and prices on overseas markets were reasonably good, but there were problems with apples and table grapes. The large quantities of Golden Delicious apples that were still available from cold-rooms in Europe when South African apples arrived there had a detrimental effect on marketing and prices.

In the case of table grapes large volumes at times as well as the poor quality of grapes in a few consignments had a depressing effect on marketing. Increased competition from Argentina also played a role, particularly in the case of apples on markets on the Continent.

Owing to the fact that exports of the most important kinds of fruit cannot increase indefinitely, and because Britain's entry into Euromart may lower the profitability of exports, local marketing of dessert fruits is at present receiving more attention than in the past.

Selection of disease-free sources of graftwood

The selection of disease-free graft sources for deciduous fruit is progressing well. Clone selections of cultivars of the following kinds of deciduous fruit were handed to the Plant Virus Unit for virus testing and virus removal by the Fruit and Fruit Technology Research Institute: apples (3), pears (4), apricots (4), peaches (10), plums (4) and prunes (1).

As a result of virus infection several of these clone selections are at present being subjected to heat therapy. Growing points from actively growing plants have already been successfully established on virus-free seedlings after protracted exposure at 30°C. This includes clone selections of apples, peaches, apricots and plums.

With regard to the selection of disease-free graft sources of stone and pome fruits, the scheme was limited to only two registered nurserymen in the Western Cape area. For the second positive screening, one nurseryman submitted 144 stone fruit trees, of which 38 were passed, and 1 155 pome fruit trees, 165 of which were passed.

For the third positive screening the other nurseryman submitted 45 pome fruit trees, 16 of which were passed.

Peaches

Breeding and selection

Various new parent combinations were used during the year by the Fruit and Fruit Technology Research Institute for the breeding of dessert peaches and nectarines with a yellow flesh colour. About 800 seedlings were obtained. Of the 550 dessert peach seedlings that produced a second crop, 24 were selected for further testing. One yellow-fleshed selection in particular gave very promising results in the cold-storage trials.

The dried peach selection again produced products of a very high quality. Further research is being carried out to establish whether it is in every respect satisfactory for release to the industry as a new cultivar.

Because improved breeding material and cultivars are still important, the evaluation of selections and mutations of local cultivars is at present receiving as much intensive attention as imported cultivars and plantings have been made in various regions.

Rootstocks — Since two peach rootstocks, viz Okunawa and Nemaguard, are now available and can be propagated vegetatively and are also resistant to some eelworms, a survey was started to compare Kakamas and Culemborg on these two rootstocks with the same cultivars on peach seedlings from the Du Plessis cultivar, which is preferred by nurserymen, and the "varkperske". The plantings were made in July 1971 on the Bien Donné and Robertson experimental farms of the Institute.

Pruning — Kakamas and similar peach trees usually grow very large and bear relatively little while they are

young. Trials are at present being conducted on pruning methods to eliminate these disadvantages. In one instance light pruning during the first five years produced quite a bit more fruit and larger crop weights than severe pruning, but the fruit was rather small.

Diseases — Die-back of peach trees again occurred fairly frequently. One kind of fungus that occurred fairly generally was identified as *Polyporus adustus*. Brown rot, caused by *Monilinia fructicola*, as well as rhizopus rot *Rhizopus nigricans* again occurred frequently, but could be well controlled by combining a spraying of the orchard with a dip treatment after the harvest. Dichloran as well as dichloran with captab gave good results.

Fruit-piercing moth — The repellent effect of paraffin pressure lamps, with which good results had earlier been obtained against this moth, *Serrodus partita*, was compared with that of liquid petroleum gas lamps. In the vicinity of the experimental lamps the average decrease in the number of moths over a period of 12 nights was 85 per cent for the gas lamps and 84 per cent for the paraffin pressure lamps. These two lamps are, therefore, more or less equally efficient. Since only 12 lamps were used in an orchard of 2 ha, as against the recommended 15 lamps per ha, the number of moths was on the whole still high in the orchard.

Apples

Breeding and selection — From the final evaluation trial with apple selections on the Elgin Experimental Farm it is clear that there is one selection that is very promising, particularly for the early local market. This apple ripens during the first week of February, has an attractive, homogeneous red colour and has a very pleasant taste. Preliminary trials showed that this apple could be cold-stored for about two months.

Nine other promising crosses as well as 20 imported cultivars were planted in various apple regions. Quite a few other imported cultivars were also frameworked onto mature trees on the Elgin experimental farm in order to determine quite soon whether the cultivars have any promise under South African conditions.

The planting of two spore-bearing cultivars, viz Starkrimson, a red apple, and Starkspur Golden Delicious, produced their second crop this year. Starkrimson is about 14 days later than Starking, and its keeping quality is comparable to that of Starking.

The apples of Starkspur Golden Delicious give the impression that they are very much subject to russetting, but close investigation showed that the percentage of russetting is no higher than that of the ordinary Golden Delicious.

Rootstocks — Owing to the advantages of smaller trees, producers are showing more and more interest in rootstocks that can control growth, and research on rootstocks is enjoying high priority. Golden Delicious and Granny Smith on 19 rootstocks were planted in statistical trials at Elgin and also in the vicinity of Ceres.

Growth retardants — Trials with the growth retardant Alar were continued and the progress was so encouraging that trials are now being planned on a commercial scale. This preparation has great potential for limiting tree size, particularly if it is taken into account that dwarfing and semi-dwarfing rootstocks are not yet available commercially.

Re-establishment — Research was conducted on methods for determining in advance whether problems could be expected when re-establishing any orchard. Golden Delicious seedlings in small pots of soil from existing apple orchards showed re-establishment problems similar to those experienced in the field. Good results were obtained by fumigating with EDB in some cases, and with CP in others.

This trial proved that it should be possible to design a quick, cheap method for determining whether re-establishment disease occurs and what fumigating preparation should be used.

Planting systems — In the sixth year after planting, palmetta trees planted at different spacings bore the following masses of fruit per ha:

Spacing	Golden Delicious (metric tons per ha)	Granny Smith (metric tons per ha)
3,7 x 1,8 m	85,8	52,5
4,5 x 2,7 m	60,1	39,9
5,5 x 3,7 m	39,1	27,7

The processing of data concerning palmetta and other trees, however, showed clearly that the high production should be ascribed mainly to the number of trees per ha and not to the shape of the trees.

Thinning — In co-operative trials, spraying with chemical preparations was carried out for the second year on the same trees on 12 farms. To date the results show no cumulative effect, and the tendency to miss a season or bear heavy and light crops alternately could also not be eliminated by chemical thinning.

Another unexpected finding is that the hormone thinning preparation yields varying results. Although chemical thinning saves a good deal of labour, it is clear that it must be considered a preliminary thinning only and must be supplemented by later thinning by hand to obtain a homogeneous distribution of fruit on the trees and the best fruit size.

Bitter pit — Good progress was made in a fundamental investigation of the cause of bitter pit in apples. It has long been known that in this case the calcium status of the fruit plays an important role and that spraying with a calcium nitrate solution reduces bitter pit. In an investigation of the intake and distribution of calcium by the fruit it was found that 30 to 50 per cent of the calcium applied on the surface is absorbed, but that only 5 per cent of this is carried to the leaves.

It is concluded that calcium most probably reduces the development of bitter pit scars by the maintenance of cell compartmentalisation and the improvement of the structural strength of the cell walls.

Diseases — In 1971 large financial losses were caused by the development of fusicladium during the cold-storage of Granny Smith apples from certain farms. An investigation of this problem showed that it was largely the result of inefficient control of the disease during the growth season, followed by very favourable conditions for the disease shortly before harvesting time. In 1972 the effect of spraying shortly before harvesting time with various fungicides was tested and the spray deposits are now being determined.

The results for one of the preparations, captab, are already available, and it was found that this kind of spraying is not dangerous to humans. Even on apples harvested immediately after spraying, the deposits were less than 5 p.p.m., which is much lower than the permissible tolerance value of 15 p.p.m. of captab.



The characteristic symptoms of storage fusicladium on a Granny Smith apple

In exporting Granny Smith apples quite a few cases of stem-end rot occurred. The fungus involved was identified as *Physalospora obtusa*. The rotting occurred particularly among apples with stems broken off during picking.

Ultra-low-volume spraying where fine drops of the active constituents are suspended in oil gave much better control against mildew and fuscladium in trials. Only 10 to 20 litres of spray were used as against the 3 500 litres required for conventional spraying with a water medium.

Die-back owing to wood rot and root rot still occurs and these problems are still receiving much attention.

European red mite — The European red mite *Panonychus ulmi*, a serious pest in most fruit-producing countries but till now not encountered in South Africa, has now been found in limited parts of the Western Cape. A survey showed that it is not yet present in other regions.

In a crash programme of trials on a heavily infested farm it was found that the new pest is very hardy against pesticides normally used against the red spider mite in the early and middle season. Fortunately it would also appear, however, that the European red mite strain in the Western Cape is vulnerable to mite killers used later in the season against the ordinary red spider *Tetranychus cinnabarinus*, but it is clear that extra costs will have to be incurred because the new pest starts earlier in the season.

Cold-storage

Superficial scald — In 1970/71 complaints were still being received about the development of superficial scald in spite of the fact that diphenylamine (DPA) wettable powder was used as a dip preparation.

Experimental work has proved that dipping for 15 to 30 seconds in a suspension or emulsion of DPA gives good control over the development of superficial scald in Granny Smith apples for a period of five months at $-0,5^{\circ}\text{C}$. When the storage period is extended to seven months, however, the DPA emulsion gave better protection than the DPA wettable powder.

A diphenylamine emulsion appeared on the South African market during 1972. The emulsion has the advantage that it need not be constantly stirred like the wettable powder suspension. It was found that where the DPA was used as a drench with a production of 2 728 litres (600 gallons) a minute for 110 seconds per bulk container, only 142 ml ($\frac{1}{4}$ pint) of the emulsion had to be added after 30 bulk containers had been

treated. By means of this technique a concentration of 2 000 p.p.m. could be maintained during treatment with DPA.

Controlled atmosphere storage

Golden Delicious and Starking apples were stored in an ordinary cold room, a controlled atmosphere (CA) cold room and a plastic tent installed as a controlled atmosphere cold room inside an ordinary commercial cold room. The oxygen in the CA cold room was kept between 3 and 4 per cent. The carbon dioxide in the CA tent was kept at 0 per cent, while this gas in the CA rooms was kept between 1 and 2 per cent in one room and between 3 and 4 per cent in the other. The fruit was stored for $7\frac{1}{2}$ months and examined after 1 and 2 weeks at room temperature.

Golden Delicious apples in the ordinary CA cold rooms were preferred to the fruit stored in the ordinary atmosphere cold rooms. Fruit stored in the CA tent had a noticeably poorer quality than that stored in the ordinary cold room.

Starking from the CA cold room also kept its green basic colour better than that from the cold rooms with the ordinary atmosphere. In the case of Starking the testing panel also gave preference to CA-stored fruit.

Apple rings — Apple rings are usually not treated with sulphur, but sulphur dioxide is introduced into them by dipping the fresh apple rings in a metabisulphite solution before they are dehydrated.

The absorption of sulphur dioxide achieved by dipping Granny Smith apple rings in solutions of sodium metabisulphite was investigated. Sample rings dipped for 5, 10 and 15 minutes respectively in solutions of the same strength, contained the same amount of sulphur dioxide after dehydration. The strength of the dip solutions, however, influenced the concentration of sulphur dioxide in the dry product.

Samples of apple rings, previously dipped in separate solutions of 1,3 and 5 per cent of sodium metabisulphite, contained 337 and 782 p.p.m. of sulphur dioxide respectively after dehydration. The loss of sulphur dioxide during storage of the dry apple rings was not influenced by the previous treatment.

In another trial it was found that concentrations of up to about 20 per cent of sodium metabisulphite did not cause the discoloration of apple rings. The rings, however, must not come into contact with iron.

Virus diseases — A survey of commercial apple orchards showed the wide-spread occurrence of apple mosaic in Golden Delicious, Granny Smith, White Winter

Pearmain, Jonathan, and Ohenimuri. Owing to the unequal distribution of this virus in apple material, indexing with woody indicators yields varying results.

Successful transmission of the apple mosaic virus to herbaceous plants and the development of an antiserum against the virus, now makes rapid detection possible. The serological relationship between the apple mosaic virus and the necrotic ring pot virus *Prunus* was confirmed. However, they are not identical.

Rubbery wood was noticed in various apple orchards where it leads to deterioration of Starking, Granny Smith and Golden Delicious trees. Indexing revealed the viral nature of this disease phenomenon.

Flat limb is latent in various commercial apple cultivars without any visible deviations being noticeable. In the cultivar Gravenstein which is still cultivated sporadically in the Western Cape, severe infection, with a detrimental effect on growth vigour, was noticed. Indexing revealed the viral nature of this disease phenomenon.

Ring spot and *russeting* were not noticed in infected orchards at Elgin this season, possibly as a result of the higher average temperatures for the period from November to March. This stresses the importance of accurate indexing over two or more seasons, which makes the provision of virus-free plant material a time-consuming process.

Pears

Breeding and selection — The different types of Bon Chrétien are now five years old and Bon Chrétien E has again yielded a considerably larger crop than the ordinary Bon Chrétien. This type produced an average of 72,43 kg per tree as against the 58,53 kg of ordinary Bon Chrétien. Bon Chrétien B produced the highest yield of 73,31 kg per tree, but reverts to ordinary Bon Chrétien and can thus not be considered a stable mutation.

Handling and storage — In South African pack houses the mechanical emptying of bulk containers is fast being replaced by immersion in water before sorting and packing. Many of the pear cultivars, however, sink in water and the specific gravity of water must thus be increased to make water handling possible.

However, increasing the specific gravity by means of sodium carbonate, which was tested first, produced problems. It was then found that sodium sulphate gave good results. Concentrations of as much as 2 per cent caused no damage, not even to the very vulnerable cultivar Beurre Bosc. As a result of the fine deposit of

salt formed on the pears after drying, it is necessary to rinse the pears with clean water after removal from the tank.

Quality of various pear cultivars in a cardboard pack — During the testing of the pre-cooling requirements for the packing of pears in polyethylene bags (grade 150) and unventilated, telescopic, corrugated cartons, it was found that internal decay developed in all the pear cultivars except Packham's Triumph if the pears were stored at a temperature of 4,5°C. The inclusion of calcium in the pack did not decrease the occurrence of internal decay.

In this pack the carbon dioxide concentrations were high in the most cases, while the oxygen concentrations were low. The cultivar Bon Chrétien was most susceptible to physiological damage when stored at warmer temperatures. At -0,5°C, however, Bon Chrétien pears store well in this pack. After being stored for 4 months, the pears in the carton pack were considerably better than those in the ordinary wooden box.

Packham's Triumph pears store very well in this pack, even when stored at 4,5°C for 3 months.

The trials again showed that the success of this pack depends on the use of pre-cooled pears only and on the correct closing of the polyethylene bag before the lid is put on.

Polyethylene wrapping paper — Perforated polyethylene wrapping paper was compared with the ordinary sulphite wrapping paper in the carton pack. The polyethylene wrapping paper prevents scratch marks in the packing of Bon Chrétien pears to a larger extent than the ordinary sulphite wrapping paper.

This experiment showed that the pears packed with polyethylene wrapping paper kept their green colour better and were also less susceptible to internal decay than pears packed with the ordinary paper. The costs connected with polyethylene wrapping paper are, however, relatively high and further trials are needed before it can be decided whether the increase in packing costs is justified.

Virus diseases — The occurrence of stony pit and russet rings on pears was again generally noticed in commercial orchards. Where these diseases occur together in Beurre Hardy, they cause a great deal of damage. Only 30 per cent of the fruit was marketable in an orchard that was completely cultivated during the growth season.

There are indications that russet rings are associated with the seedborne vein yellows virus and the

apple chlorotic leaf spot virus. The last-mentioned two viruses are responsible for a high percentage of the infection in local pear orchards.

Plums and prunes

Breeding and selection — The first locally-bred Japanese plum cultivar, Songold, was released to the industry during February 1972. It was extremely suitable for the export industry since the fruit is big and has an excellent keeping quality. To date Songold is also very hardy against bacterial spot and delayed budding.

The fruit is initially yellow and it develops a reddish colour when completely ripe. Fruit of the Songold ripens during the second to third week of February and is 5 cm in diameter on average.

Fruitone — As against the previous year, Fruitone (2,4,5 trichlorophenoxy propionic acid) applied at 10 and 20 p.p.m. to trees with the Van der Merwe bud deviant of Prune d'Agen led to no damage to shoots or increase of production (crop mass). The fruit size and the percentage mass loss in drying was also not influenced. Spraying with Fruitone, however, increased the sugar quality and considerably improved the grading of the dried product.

Diseases — In the case of plums, bacterial canker was formerly attributed to the pathogen *Pseudomonas syringae*, the organism that causes this disease in apricots and peaches. Recently, however, another organism with the same characteristics as *Pseudomonas morsprunorum* was isolated on plum and cherry trees with the symptoms of bacterial canker.

During a survey of infectious chlorosis and an appearance of bark split among plums various sap-transmissible viruses were isolated. The connection between these viruses, which include prune dwarf, apple chlorotic leaf spot and *Prunus* necrotic ring spot, and general die-back of stone fruit. Particular attention is now being paid to the role of the rootstock in this connection.

Apricots

Breeding and selection — Two of the most promising selections from the breeding programme are now receiving further attention. One excels as a dessert apricot, but its drying and canning characteristics are not good. The other selection has striking, beautiful fruit with a good keeping quality. Evaluation of the two selections is being continued.

From the seedlings obtained from Canino pips imported from Israel two selections are now being evaluated. Because it is often said that the Bulida that is planted on a large scale in the Republic is different from

the Bulida cultivated in Spain, genuine Spanish Bulida material has now been grafted on to mature apricot trees.

Diseases — Die-back of apricots is still a big problem. Until recently bacterial canker was put forward as the most important cause, but another fungus, *Eutypa armeniaceae*, which is also responsible for the die-back of older apricot trees, has now been found. This fungus occurs in most other fruit-producing countries, but has to date been unknown in the Republic.

Berries

Storage — There is much interest in the out-of-season shipping of fruit to overseas markets. For this purpose, berries are much in demand as a luxury item. One season's storage trials showed that youngberries, thornless youngberries, boysen berries and brambles can be stored for five days at $-0,5^{\circ}\text{C}$. Brambles had the best keeping quality.

A small, experimental shipment of youngberries, sent overseas by plane by a farmer, arrived in London in very good condition.

Spoilage of canned berries — The spoilage of canned berries by heat-resistant moulds was further investigated. Canned youngberries and syrup were inoculated with spore suspensions of *Byssoschlamys fulva*, which may also cause spoilage in canned Bulida apricots. Under the trial conditions heat treatments of 15 minutes at 100°C were insufficient to eliminate spoilage. The application of more drastic heat-treatments led to mechanical damage to the contents if the cans were not handled very carefully. The addition of calcium salts to the contents did not noticeably stabilise the texture of the berries.

The reprocessing of the canned berries after one week in order to destroy spores that had germinated because of the heat-treatment, was unsuccessful. The spores that germinated after canning developed so rapidly that deterioration of the contents could be observed.

SUMMER RAINFALL AREA

Production trends

During the past few years large-scale, and in many cases injudicious, peach plantings were made in the summer rainfall area.

During this period more and more farmers started showing interest in the cultivation of strawberries. During the past season this interest reached a hitherto unknown level and unusually large plantings were made.

Inter alia a company was formed which planted about sixty hectares of strawberries on various farms. Overseas there is a large demand for South African strawberries during the period October to April, but this is unfortunately just the time of year when the quality of strawberries is considerably reduced owing to the warm summer months. It would appear that even this year there will be over-production of strawberries on the local markets.

Besides the larger plantings, the availability of State-certified virus-free and eelworm-free strawberry plants has also led to higher yields per unit of area. During the past season six registered nurserymen in the summer rainfall area provided 921 700 virus-free and eelworm-free plants to the industry. Preliminary indications are that these plants are already producing higher yields of better quality. Owing to the advantages offered by this material, farmers will in future get the same or higher yields on smaller areas with better care.

The State-controlled virus-free and eelworm-free strawberry scheme is a very important development in the strawberry industry.

It was also notable during the past season that interest in table grape production has considerably increased in the summer rainfall area. It may be forecast that larger areas will be planted during the next few years. The interest is chiefly in early cultivars such as Pirobella, Muska, Golden City and Queen of the Vineyard.

There is also quite a bit of interest in the three new peach cultivars which the Horticultural Research Institute released to nurseries during the past few seasons. This applies particularly to the very early white-fleshed dessert peach Orion and the yellow-fleshed free-stone midseason dessert peach Ingwe.

Census

The first part of the census of plantings and cultivars of deciduous fruit and table grapes in the summer rainfall area has appeared. This census, carried out on the instruction of the Secretary for Agricultural Technical Services, gives the data for the Transvaal, the Orange Free State and the Northern Cape.

According to these surveys peaches and table grapes are the most important types of deciduous fruit in the Transvaal. There are already more than 1,1 million peach trees planted in the Transvaal. The most important peach cultivation region in the Transvaal is the Krugersdorp-Magaliesburg area with more than 450 000 trees, followed by the Witwatersrand and the Middelburg and Lydenburg areas, each with more than 100 000 trees.

Grobblersdal is the most important table grape area with more than 650 000 vines (out of a total of 1,1 million), followed by Warm Baths-Potgietersrus with more than 200 000 and Pretoria-Bronkhorstspuit with more than 100 000 vines. Of the other kinds of deciduous fruit cultivated in the Transvaal, apricots are the most important, with a total planting of 71 000 trees.

Plums, apples, pears and cherries are relatively unimportant in the Transvaal.

According to the survey in the Eastern Free State, peaches, with 355 000 trees, are the most important crop with the highest numbers in the districts of Ficksburg and Fouriesburg. There are about 100 000 cherry trees, Ficksburg and Clocolan-Ladybrand being the most important districts. About half the total apple plantings (115 000 trees) in the Eastern Free State are in the Ficksburg district. Apricots account for about 50 000 trees, plums 25 000 and pears fewer than 15 000 in the Eastern Free State. The plantings of yellow-fleshed clingstone peaches amount to 70 per cent and Kakamas plantings to 16 per cent of the total.

In the Northern Cape grapes are the most important of these crops with a total of 1,5 million vines. Wine or raisin types constitute much more than half of this. Barlinka is far and away the most important of the table grapes. The areas in the vicinity of Barkly West-Vaalharts and Douglas-Modder River are the most important viticultural areas in the Northern Cape.

Peaches are the second most important horticultural crop in this area, with a total of 186 000 trees, followed by apricots with 21 000 trees. With regard to peaches, the area at Barkly West-Vaalharts is the most important peach-producing area with more than half the trees in the whole of the Northern Cape.

The Eastern Free State is the only area where cherries are cultivated, and the overwhelming majority of the apples in the summer rainfall area are grown there. There are also a reasonably large number of pear trees in the Transvaal, viz 37 000.

Yellow-fleshed clingstone peaches are the most important kind of peach cultivated in all three areas.

The large plantings of early and midseason table grapes in the Transvaal indicates that producers are exploiting the high prices of the early market. On the other hand the Northern Cape concentrates mainly on midseason to late-season cultivars and thus experiences quite a bit of competition from the Winter Rainfall Region. These cultivars are chosen to avoid late spring frost that could damage early cultivars.

Nurseries

In 1971/72 there were 1 076 registered nurseries (excluding vineyard nurseries) in South Africa — 39 more than in the previous year.

558 of these were in the Transvaal, 319 in the Cape Province, 168 in Natal and 41 in the Free State.

Red scale, followed by Ross scale, white peach scale and pernicious scale are some of the most important declared pests and diseases that occurred in the various general nurseries. Eelworm, crown gall and woolly aphid are the three most important pests that occurred in the deciduous fruit tree nurseries.

A total of 46 nurseries were put under quarantine during the year under review — 37 in the Cape Province, 1 in the Transvaal and 1 in Natal.

The large number of complaints received from farmers about poor trees and vines that they had bought from some nurseries again showed what was wrong in the cultivation of deciduous fruit in the summer rainfall area. Usually the farmers also bought large quantities of this undesirable plant material.

Much success was achieved with the scheme for virus-free and eelworm-free strawberries. Registered nurserymen in the Transvaal released almost a million plants to the strawberry industry. The vigour and larger fields of this material are very noticeable compared with the virus-infected material.

Production

The following number of trees were available in registered nurseries during the year under review: Peaches, 1 600 000 (Transvaal 847 000 and Cape 753 000); plums 252 500 (Cape Province 159 100 and Transvaal 86 200); pears 309 800 (Cape Province 263 500 and Transvaal 45 300); apples 841 200 (Cape Province 792 500 and Transvaal 45 900); and apricots 491 700 (Cape Province 407 200 and Transvaal 82 100).

Peaches

The first small-scale commercial plantings of about one hectare of the peach cultivars released in 1967 by the Horticultural Research Institute, viz Earlibelle, Sunray and Golden Amber, in the vicinity of Pretoria, Middelburg (Tvl) and Parys (O.F.S.) came into bearing during the past season. Earlibelle planted in the northern part of the Magaliesberg area started ripening as early as 10 October. Since these were then also the earliest peaches marketed, some boxes (5 kg per box) sold for as much as R2,00. One producer received an average price of R1,60 per box.

The cultivars Sunray and Golden Amber produced good crops in the vicinity of Parys and Middelburg (Tvl). Prices for these yellow-fleshed peaches varied from 80c to R2,00 per box.

According to the most recent survey of deciduous fruit plantings in the summer rainfall region, 55 hectares of Earlibelle, 51 hectares of Sunray and 36 hectares of Golden Amber have already been planted. Most of the plantings are not yet bearing.

Issuing of budwood

The following quantities of peach trees of three new cultivars bred at the Horticultural Research Institute were released to registered nurserymen:

Orion	—	17 000 buds
Albatros	—	9 500 buds
Ingwe	—	9 700 buds

Trees of these cultivars will be made available to the fruit industry during the winter of 1972.

Breeding and selection — The late cold that occurred on 22 and 23 August 1971 destroyed the fruit of the crossings and of most of the seedlings that flower before then. Although the cold caused much damage, it was a blessing in disguise from the point of view of breeding. It was then possible to select seedlings that flower late at the end of August, but that do not suffer from delayed budding and that bear well.

Fourteen selections from the F2 progeny of Keimoes x Jubilee crossings were also promising with regard to their late-flowering characteristics. Some of these selections flowered as late as 10 September and they are all yellow-fleshed clingstone peaches. Besides these characteristics they also did not suffer from delayed budding. Owing to their late-flowering characteristics some of these selections ought to be well adapted to the Eastern Free State, where late and untimely cold is a serious problem.

One of the yellow-fleshed clingstone peach seedlings that has much in common with the cultivar Oom Sarel, this year flowered three weeks after Oom Sarel (26 August), but ripened from 22 November, i.e. three weeks earlier than Oom Sarel. The adaptability and performance of these seedlings will be studied closely during the next few years. If it flowers late and ripens early every year, as well as producing crops of good quality, such a new cultivar will be of very great value to the canning industry. Oom Sarel ripens towards the middle of December, and an earlier canning type will spread the canning season over a longer period.

During this season about thirty peach selections were frameworked onto established rootstocks on the

TABLE GRAPES

WINTER RAINFALL AREA

farms of five of the evaluators in the Transvaal, the Free State and the Northern Cape. Of the 24 selections budded on three farms during the winter of 1970 in the Eastern Free State, nine were very promising in respect of flowering time, ripening time, fruit size and fruit quality. The selection 6/62 impressed at Middelburg (Tvl.).

The frameworking of trees to get rid of undesirable cultivars is now an established practice in the Highveld Region. Excellent results are achieved in this way and the frameworked trees are already producing a small crop during the second year.

In the second half of the fruit season sooty mould was a problem in the Transvaal. It discoloured the fruit either partly or completely and thus made it unmarketable. The fungus was identified as *Pullularia pullulans*.

Cherries

Owing to the general occurrence of bacterial canker infection in the cherry orchards, the annual yields of sweet cherries show a steadily decreasing trend. Most producers, however, are now beginning to realise that regular spraying against this disease is essential, and more and more attention is being paid to this. The disease cycle of bacterial canker on cherry trees in the Eastern Free State, however, will have to be investigated much more intensively before absolute control measures can be provided.

After initial problems, particularly in respect of poor soil conditions, the established virus-free rootstock and cultivar foundation trees on the experimental farm of the Horticultural Research Institute are now in good and healthy condition. Propagation studies with cherries in the Eastern Free State have already been started since it appears that it is particularly the propagation of cherry rootstocks that is a limiting factor in making virus-free material available to the industry.

Virus diseases

An investigation into the virus status of various types of rootstocks used for cherries in the Eastern Free State produced one clone that is, according to trials, free of sap-transmissible viruses. Further virus tests are now being carried out on this clone before it is included in rootstock evaluation trials.

Weather conditions in general were suitable for table grapes and there were no serious setbacks on account of wind, hail, extraordinary diseases or insect pests in the chief production areas.

In the Hex River Valley, where drought had done a lot of damage during the past few years, water from the Sand River Irrigation Scheme was made available to producers from 3 January to 15 March and helped a lot to improve conditions.

Owing to a lack of better cultivars, existing cultivars are still used chiefly for new plantings. This means the planting of more Barlinka grapes, and since Barlinka is already the predominant cultivar, the only result can be a further drop in the price of Barlinka.

The evaluation of six selections from the breeding programme has advanced so far that they were planted in a final statistical trial, and 13 other crosses seem very promising and are already being multiplied. Six of these crosses are white types, ranging from mid-season to late season. White grapes are badly needed in order to improve the proportion of white to black grapes on the overseas market.

The testing of imported cultivars is also advancing satisfactorily. The evaluation of Black Mikveh x Alphonse, Royal Emile Terhyden and Italia is now also being continued in the course of co-operative trials on farms of producers in the Hex River Valley and in the vicinity of Paarl.

Mutations and seedlings

The attention of producers is regularly drawn to the possibilities of mutations and seedlings. Mutations of Alphonse Lavallee and Golden Hill and a New Cross seedling are already in bearing on the Bien Donné and Hex Valley experimental farms. During the past season a Barlinka mutation and two seedlings were reported, probably derived from New Cross and Barlinka.

Commercial cultivars

The selection of the best types of existing cultivars is enjoying top priority in the search for better table grape cultivars. The preliminary selections with Waltham Cross, Barlinka, Alphonse Lavallee, Queen of the Vineyard, New Cross, Almeria and Salba have already been completed on farms in the various regions. The selected material is at present being evaluated on the Bien Donné, Bellevue and Hex Valley experimental farms.

During the winter of 1971 two Waltham Cross clones, numbered 22 and 44, which have done well on the average over a period of three years, were made available to the industry. This is merely a preliminary release. The evaluation is being continued to establish beyond doubt which selection is the best. The final clone will then be virus-purified.

Crop data for two years for the Barlinka, Alphonse Lavallee and Queen of the Vineyard cultivars are already available and there are indications that better types will also be found among these cultivars.

The grafted vines of the selected clones of New Cross, Almeria and Salba will come into bearing for the first time during the 1972/73 season.

Leaf scorch and low quality crops caused severe damage on certain farms in the Hex River Valley this year. In some cases vines died completely. Investigations revealed that this phenomenon was due entirely to the salt content of the water from certain boreholes and the injudicious use of such water.

Diseases

The *red leaf* phenomenon in table grapes in the Hex Valley has been known for a long time, but has increased so much, especially during the past few seasons, that an investigation was launched.

It was concluded that this phenomenon is probably due to the cumulative effect of years of unfavourable conditions such as lack of water at certain times during the growing season, over-heavy bearing and late crops that exhausted the reserves of the vines and consequently affected the growth vigour. The gradual increase in the brack content of the soil also plays a part.

Crown and root rot in grapes was investigated further. It was found that, unlike Jacquez, the rootstock Richter 99 is very susceptible to rot caused by the fungus *Phytophthora cinnamomi*.

Laboratory tests have shown that vine sulphur, which used to be regarded as harmless, can kill acult tortoise beetles. The release of predators was continued and 120 000 tortoise beetles (mostly *Nephus quadrivittatus*) were released on two farms in the Hex River Valley.

A moderate decrease in the number of bunches infested with mealybugs was observed on one plot where beetles were released and a dramatic decrease was observed on another plot — from 94 per cent to 6 per cent bunch infestation.

On plots that were sprayed for mealybug the previous year, mealybug infestations were still low and

were still at the economically acceptable level in one plot. This indicates that the effect is considerably prolonged if insecticides are thoroughly applied.

Virus diseases — An investigation into the effect of viruses on the production and quality of table grape clone selections is being undertaken in co-operation with the Fruit and Fruit Technology Research Institute. Despite severe infection with stem grooving, leafroll, corky bark and fanleaf, no significant differences in yield have been established so far, although the effect of fanleaf and leafroll is already obvious in the form of seedless berries and poor colour in Queen of the Vineyard and Barlinka respectively.

Botrytis — Grey rot caused by *Botrytis cinerea* is at present controlled chiefly by the application of sulphur dioxide during and after the harvest, but various experiments with preharvest applications in the vineyard combined with post-harvest applications of sulphur dioxide again confirmed the importance of field applications in the control of this disease.

Waltham Cross grapes were inoculated with a spore suspension of *B. cinerea* and sulphur dioxide gas (in the form of a solution of sodium metabisulphite) was applied at different intervals after inoculation. It was found that sulphur dioxide does not control the rot effectively if applied 12 hours or longer after inoculation.

Selection of disease-free graft sources — The selection of disease-free table grape graft sources is progressing well and clone selections of the 17 local and 6 imported cultivars have already been handed over to the plant virus unit by the Fruit and Fruit Technology Research Institute for virus testing and purification. Several of these clone selections have already been subjected to the process of heat therapy on account of infection with one or several viruses.

Exports

The grape export season began with criticisms of the quality of South African export grapes. Specific criticisms concerned sour grapes, dry stalks, the absence of bloom and the presence of *Botrytis cinerea* rot in a number of consignments at the beginning of the season.

However, the quality improved considerably during the peak season when only Barlinka was exported.

A survey of the quality of grapes of 20 selected Barlinka producers was undertaken. Grapes from producers whose exports were of good quality throughout as well as of those whose product was found to be of poor quality on arrival overseas, were included. The general condition of the grapes was good.

Barlinka grapes are the hardiest of the export cultivars and further surveys on the quality of this cultivar are unnecessary. A survey on Queen of the Vineyard and Waltham Cross grapes is, however, necessary.

Hydrocooling of table grapes

A pilot trial on hydrocooling showed that the temperature of grapes can be reduced to the storage temperature in under 30 minutes. This treatment was effective from the point of view of cooling, but resulted in notably more rot than the conventional method of cooling.

Sultanas

During the past season mechanical equipment that is already used for the preparation of unbleached sultanas in Australia and has been made available by the South African Dried Fruit Co-operative, was tested under local conditions at the Upton Research Station.

The rack spray, which sprays cold lye directly onto the fresh grapes on the rack, uses more lye than the traditional immersion method. According to provisional figures it would cost about R3,00 more to treat a drying rack filled with 13 tons of grapes by the spray method. However, the use of the rack spray would cut down considerably on labour.

Results obtained with the rack drier indicate that the time required for the last part of the drying process can be reduced considerably. The moisture content can be reduced from 20 per cent to the required value of 14 per cent in the space of a day. Without the drier it takes about four days to obtain the same degree of drying, but under poor weather conditions it can take considerably longer. The relatively high temperature of the fruit during mechanical drying had the further advantage that it was unnecessary after drying to remove the green tinge from the sultanas by exposing them to sunlight.

Removing dry sultanas from the drying rack is a time-consuming task and the product is often damaged in the process. Tests with the rack stripper, which is attached to the three point hitch of a tractor and driven from the power take-off, showed that the use of the stripper can effect a considerable saving of labour.

SUMMER RAINFALL AREA

During the past season 1 145 grape seedlings were evaluated, and 1 035 were eliminated on account of certain defects. Twenty-eight seedlings were so promising that they will be more thoroughly tested. Eight of these selections were exceptionally promising as regards appearance and berry size.

The selection S/BL 3 (Black Spanish x Barlinka cross), which was selected in 1969, started bearing this year and seems very impressive. Samples evaluated by the Fruit and Fruit Technology Research Institute at Stellenbosch have elicited favourable comments. This selection will also be tested in the winter rainfall area as a possible export grape.

Selection AL/BL 40 (an Alphonse Lavallee x Barlinka cross) again showed promise at Roodeplaat and in the Western Province. The Fruit and Fruit Technology Research Institute intends to send a trial consignment of this selection overseas in 1973/74.

In order to speed up the evaluation of table grape selections and get a better indication of adaptation in various climatic areas and under commercial conditions, fourteen of the most promising selections were tested on farms in the Transvaal and the Northern Cape this year. Permission was given to the collaborators to plant the four selections on a bigger scale with a view to testing the local market and consumer preference.

One of the selections regarded as promising by everyone is AL/BAR 40, a black grape.

During July 1971, 1 700 Jacaranda buds and 2 300 Golden City buds were released to registered nurseries. These are the two cultivars bred at the Horticultural Research Institute.

Cockchafers — It was found that cockchafers and fruit beetles belonging to the families *Cetoniidae*, *Melolonthiidae* and *Ruteliidae* cause a considerable amount of damage in vineyards in the summer rainfall area. Most of the beetles that occur in November belong to the species *Dyspilophora trivittata*.

Results also show that there appears to be a link between climate and the incidence of these beetles.

It was also found that the brown beetles belonging to the families *Melolonthiidae* and *Ruteliidae* are very difficult to differentiate. However, progress has been made in this connection. Trials aimed at discovering control measures are being carried out.

WINE GRAPES

Production trends

During the 1971/72 season the total production of wine and wine spirit was about 3 per cent lower than the record production of the previous season. The drop in production may be ascribed chiefly to frost damage in several areas.

Sales have been showing an unmistakable swing from spirits to wine, and this trend continued during the past year. As far as the sales pattern of wine goes, there has been a marked increase in the demand for red wine. Because the industry is geared chiefly to the production of white wine at present, it appears that the increased demand for red wine is causing a shortage of well-aged red wine so that younger red wines are being sold. This could affect the sales and the swing to red wines.

The South African public is consuming more and more natural wines and becoming more sophisticated about wine. This has led to a growing interest in wines from specific farms (estates) or areas. This trend was welcomed by wine farmers and at their request the Minister of Agriculture constituted two committees to investigate the production and marketing of estate wines and wines of origin. Legislation arising from the recommendations of the committees and aimed at providing the necessary protection for, and control over, the production and marketing of such wines was tabled during the last Parliamentary session. At the same time an acceptable system was set up in accordance with which South African wines are exported to European countries and protection for wines from specific areas is stipulated as a requirement.

The production and marketing of estate wines and wines from specific areas is a new concept for the South African wine industry and a great deal of adjustment will be required. If future circumstances are such that the system is adopted entirely it will mean a complete change in the production and marketing systems of the wine industry.

As far as estate wines go, individual farmers are entering the complicated field of finishing and marketing wines. Not only will this require a great adjustment on the part of the farmer with regard to technical knowledge, marketing procedures and dealing with the public on his farm, but farm wineries will have to be provided with the technical equipment now found chiefly in co-operatives and commercial wineries.

The Oenological and Viticultural Research Institute will also have to make a great adjustment on account of the new system in that acceptable systems of record keeping and control will have to be designed and applied in such a way that the production and marketing of wines from specific areas will be to the advantage of the consumer and producer.

Because the determination of optimal production conditions is considered of decisive importance in successful farming, the Departmental bodies in the winter rainfall area started intensive survey studies on 600 farms in the Franschhoek, Paarl and Wellington areas during the past year. Soil classifications are being

carried out and the various farming practices on the 600 farms are being identified and evaluated in order to establish which yield the best results.

In this way efforts are being made to eliminate inefficient practices and at the same time to determine which problems should be given priority for research purposes. The same procedure is also being followed successfully along the Lower Orange River where the growth arrestment syndrome is causing considerable crop losses.

So the Department is doing its best to ensure that viticulture is practised as successfully as possible. On the other hand it is feared that the recent allocation of provisional production quotas in terms of which sufficient vines have to be planted before 1976 to produce the quantity provisionally allocated, is going to mean that vineyards are planted on less suitable soils and even in less suitable areas, simply to obtain a quota. At the same time there is a stampede for planting material, which means that second and third grade material is being planted.

Viticulture in the Gordonia, Griqualand West and South-Western Free State subregions was greatly stimulated by the recent allocation of new wine quotas, and there is great enthusiasm.

In the Griqualand West subregion provisional and permanent wine quotas for the production of about 71 700 leaguers were allocated to 469 farmers and large-scale planting of wine and dual-purpose grape cultivars is expected.

In the Vaalharts area 1,2 million young vines were ordered during the past year. Arrangements were made for the planting of 2,5 million young vines in that subregion, which means roughly 1 300 hectares of vineyards.

In Gordonia exceptionally large plantings are expected this season. This may be ascribed to the good supply of water available after the completion of the Verwoerd Dam and the effort to retain the provisional quotas. The additional quotas include an extension of about 5 000 hectares of vineyard to be planted before 1975.

During the 1971/72 season 33 080 tons of grapes of 20^o Balling were received by the three depots of the Oranje wineries, still mostly sultana grapes. 9 000 leaguers of good wine and 30 000 leaguers of distilling wine were made (the figures for the previous season were 6 000 and 18 000 leaguers respectively).

In the Douglas district 4 800 tons of grapes, about 60 per cent of which consisted of sultanas, were pressed during the past season. A very high percentage of good wine is made.

Production

Planting width and training trial with Steen grafted on Richter 99 at the Nietvoorbij Experimental Farm — This trial was laid out eight years ago on moderately fertile loam, the depth of which varies from about 45 cm to 90 cm. Sprinkler irrigation is applied.

Crop data for 1972 correspond with previous results of this trial and other planting width and training trials, viz that production increases at the same row width when a bigger trellis and therefore a bigger leaf area per hectare is provided. For instance, at a row width of 3,0 m (10 feet) the 1972 production for bush-trained vines, Perold 3-strand and 1,5 m slanting trellises was respectively 11 635, 13 908 and 19 900 kg per hectare at 20° Balling.

With regard to production it was also clear that on the better (deeper) soil in this trial the leaf area per row or per hectare is of critical importance, and the planting widths far less critical. On the poorer (shallower) soils in the trial, planting widths are more critical than the leaf area and the best production per hectare was obtained with the smaller area of soil per vine.

Wines were made from the 1972 crop from eight of the twelve treatments in the trial. The grapes from all the treatments were fairly healthy and all the wines were at least of table wine quality. It is interesting that the wines from all the slanting trellises fall into the quality class this year.

Plantings width and training trial with Steen on two rootstock cultivars on the Robertson Experimental Farm, on a fertile Karroid soil about 90 cm in depth. (Sprinkler irrigation is applied.) The aim of the trial is, *inter alia*, to establish the effect of various planting widths on production on the soil type concerned.

The results obtained were in agreement with those of previous years: the 1972 crop data for Steen x Jacquez again show that with comparable training treatments soil areas per vine of 1,7, 3,3 and 6,7 m² make little difference to production per hectare, provided a planting width ratio of 3:1 is not exceeded.

However, the 1972 crop data, like those for 1971, show that although Steen x 101-14 produces better yields per hectare at all the planting widths concerned than Steen x Jacquez, a soil area per vine of 6,7 m² probably exceeds the optimum for the 101-14 rootstock. Apparently for the best production per hectare from 101-14 on the soil type in question no more than about 4,65 m² (50 sq. feet) of soil area per vine should be allowed.

Apart from the fact that Steen x 101-14 produced stronger shoot growth than Steen x Jacquez

(an average of 4,57 and 3,77 metric tons per hectare respectively), it appears that for the years 1969, 1970 and 1971 Steen x 101-14 produced an average of 6,6 kg of grapes per kg of shoot mass as against 5,5 kg from Steen x Jacquez. The 101-14 rootstock therefore also increases the fertility of the scion.

Botrytis rot caused great losses in the 1972 crop. The exceptional severity of *Botrytis* was due, *inter alia*, to the very damp, rainy conditions immediately before and during harvesting (a factor that cannot be controlled), too heavy an application of nitrogen during the preceding growing season, which caused vigorous shoot growth and denser vines, and a relatively small crop (factors that can be controlled).

At present *Botrytis* rot is a very serious problem in Steen grapes, our most important white wine cultivar. Although planting widths and training treatments that allow the grapes to hang free and get plenty of air can help a great deal to reduce the incidence of *Botrytis*, this year's crop losses show that these alone cannot control *Botrytis* without some adjustment of other cultural practices such as fertilising and irrigation and some control over the bearing of the vines — including the sugar content of the grapes.

During the past growing season three holes measuring 120 cm by 60 cm and 120 cm deep were made at each of the 23 planting width and training treatments with Steen x 101-14 and Steen x Jacquez (138 holes in all). In all cases one longitudinal side was 60 cm from a normally developed vine. A study of the roots in the side of the hole nearest the vine showed that 101-14 generally had a finer root system with a better distribution than Jacquez.

In the case of both rootstocks virtually no roots were found in the upper 25 cm (10 in.) of soil and there was no difference in root depth. It was particularly striking that roots were strictly confined to the depth to which the soil had either been prepared prior to planting or was loose in any case.

In 1972 wines were made from 14 treatments of Steen x 101-14 and from 7 treatments of Steen x Jacquez. All these grapes had been badly affected by *Botrytis* so that the quality of the wines was generally mediocre to poor. Evidently the different plant spacings and rootstocks and crop masses per hectare caused no marked differences in the quality of these wines. However, the quality of the wine appears to be linked to a fairly high sugar content and the soundness of the grapes.

Training trial with Cabernet Sauvignon in the Stellenbosch area, on deep, fairly fertile, unirrigated loam — This trial has been in progress for twelve years and was laid out statistically with five replications of the

following five treatments: Bushtrained vines, post-trellised vines, Perold 3-strand, Perold 4-strand and a 1,5 m slanting trellis treatment.

The report which follows is based on the data of six years (1966–1971) processed statistically to determine any significant differences between treatments.

Six-year average for vigour. – The 1,5 m (5 ft) slanting trellis treatment is significantly better than the Perold 3-strand and the post-trellised treatments. However, there are no significant differences between the 1,5 m slanting trellis treatment, the Perold 4-strand training treatment and the bush-trained treatment. Nor, are there any significant differences between the bush-trained, post-trellised and Perold 3-strand and 4-strand treatments.

Six-year average for production – The 1,5 metre slanting trellis treatment is significantly better than all the other treatments, and the 1,5 metre slanting trellis, the 3-strand and the 4-strand treatments are significantly better as a group than the post-trellised and bush-trained treatments.

Six-year average for wine quality – Since 1966 wines have been made from grapes from the various training treatments and evaluated organoleptically. Although there were five replications for each treatment, the lack of winery facilities made it impossible to make more than one wine from the combined grapes from the various plots (replications). It was therefore not possible to process the results of the organoleptic evaluation statistically. In any case there was so little difference over the six years in the points awarded to the various wines, which were all of high quality, that it is very probable that there were no significant differences in the quality of the wine.

The aim of the trial was to establish the effect of the various training treatments on the vigour, production and wine quality of Cabernet Sauvignon, which is our most important cultivar for the production of quality red wine, but a shy bearer. One can say with certainty on the basis of the trial that under favourable growing conditions, i.e. where there is never a critical shortage of soil moisture and the soil is fairly fertile, the 1,5 metre slanting trellis training treatment for Cabernet Sauvignon is to be preferred to any of the other treatments in the trial.

In view of the keen demand for Cabernet wines the results of this trial are of great practical value. Cabernet Sauvignon is a shy bearer. The results of this trial indicate that unit production may be increased by up to 53 per cent with the aid of judicious training treatments without any loss of wine quality and vigour.

Rootstock trials

In the Robertson, Stellenbosch, Paarl, Wellington, Vredendal and Lutzville areas good progress was again made with the development of rootstock trials and the collection of experimental data.

The trial at *Stellenbosch* (Nietvoorbij Experimental Farm) has been in progress for seven years on red loam, under sprinkler irrigation; the trial at the *Robertson* Experimental Farm is also seven years old, on fertile, fairly deep Karroid soil under sprinkler irrigation; the trial at the Nederburg estate at *Paarl* has been in progress for eight years on heavy, gravelly loam under sprinkler irrigation; the trial at *Wellington* is eight years old, the soil is shallow, gravelly sand with clay at a depth of about 40 cm, and this is the only rootstock trial that is not being irrigated or trained. The trial on *Vredendal* silt has been in progress for four years on a deep, fairly heavy silt under flood irrigation and the one established on *Vredendal* Karroid soil is seven years old on a sandy Karroid soil under flood irrigation.

It appears that Richter 99 is doing well in five out of six trials (areas). Richter 110 is doing well in four out of five trials, 101–14, 3306 and 143–B in four out of six trials, and 333 in all three the trials in which it was included. However, there are problems with root formation in 333 and so it is not supplied commercially by nurserymen.

Salt Creek is doing well in two out of five trials and Rupestris du Lot and Jacquez in only two out of six trials, and the performance of Jacquez is comparatively poor in all four the other trials.

Metallica is performing well in the only trial in which it was included. However, since the trial was laid out on good soil and data are available for only one year, the significance of this result should not be overestimated.

Although 143–B is performing well in four trials (areas), it is preferable to use another rootstock wherever possible because 143–B sometimes starts to decline after 8 to 12 years, and these trials have not been in progress for long.

On the basis of these results, therefore, the rootstocks Richter 99, Richter 110, 101–14 and 3306 can be highly recommended for the soil types on which they performed well in the trials.

Selection and breeding

Evaluation of released imported cultivars – Three prolific white wine cultivars, viz emerald Riesling, Flora and Burger, grafted on 99 R, were planted out in field



This imported Cabernet Sauvignon clone from Davis, California, has already been released

trials on the Robertson Experimental Farm this year. Enough vines were planted to make 250 litres of wine per cultivar.

The five released white wine varieties planted out at Nietvoorbij in field trials on a similar scale during the previous year are doing well.

Cultivars in open quarantine — Twenty-five wine grape cultivars placed in open quarantine at the Oenological and Viticultural Research Institute by the Division of Plant Pest Control in 1968 because indexing tests showed that they were infected with only a weak strain of the fan leaf virus, were established on three-year-old Jacquez rootstocks by means of high-working during the past season. The object is to obtain about 30 vines per cultivar, which is considered sufficient for a provisional determination not only of the oenological value of the cultivar but also of the quality of the wine. The vines that were established grew very well and showed no symptoms of virus infection.

Enough rooted rootstocks were also planted in the new variety collection so that when a cultivar is released or placed in open quarantine it can immediately be established on various rootstocks by means of

high-working. It has been found that this is the fastest and most effective method of determining the oenological value of a new cultivar in our climatic conditions.

During the year under review ten vines were established in the rootstock collection at Nietvoorbij from each of the five imported rootstock varieties and the three American *Vitis* species placed in open quarantine in 1971.

At the Robertson Experimental Farm 50 vines of each of the ten well-known imported rootstock cultivars placed in open quarantine in 1968 were planted out. The idea is that, on this fertile soil, enough material will soon be obtained to plant a comparative rootstock trial.

Evaluation of crossings

Thirty four wines were prepared on a small scale (3 litres and less) in 1971 and 55 in 1972 from grapes from the crossings of the Department of Viticulture of the University of Stellenbosch. The object is to make it possible to evaluate the crossings for wine-making.

Crossings that produce promising wines in two successive years will be considered for multiplication and further study.

Locally bred rootstock crossings – Ten vines from each of the ten locally bred rootstock crossings were also established in the rootstock collection at Nietvoorbij for further observation. Fifty vines of the four most promising were established at Robertson.

Clone selection – During the past season the crop and shoot masses of 143 clones grafted on imported Rupestris Saint George in the clone garden at Nietvoorbij were recorded for the third time. Apparently only one Clairette Blanche, two Colombard, two Hanepoot, one South African Riesling, one red Muscadell and four Steen clones performed well during all the seasons.

Outstanding vines in a large block of Cabernet Sauvignon at Nietvoorbij were examined for the second time and screened. It is hoped that final screening of a larger number of Cabernet Sauvignon parent vines for comparative clone selection will be possible during the next season.

Re-indexing clone material – The O.V.R.I. had 129 clones re-indexed unit under code names at the virus during the past season. In 1965 the clone material was grafted on a "virus-free" Rupestris Saint George rootstock clone imported from Davis. The following year it was found that this rootstock clone was infected with leaf roll and scaly bark.

The comparative evaluation of the re-indexing shows that:

Clones of which the parent vines were indexed positively for fan leaf in the past have now been indexed positively for fleck, with two exceptions. Fortunately fleck is a far weaker strain of virus than fan leaf and cannot be transmitted by nematodes.

Although leaf roll infection could be seen to be severer in some clones than in their parent vines, there are also many clones that are still either free from the infection or have it in a very slight degree, although their parent vines showed severe leaf roll.

No correlation could be found between the performance of the parent vines and clones and the degree of virus infection.

Collection of wine grape cultivars at Nietvoorbij – The crop and shoot weights of 55 cultivars grafted on six different rootstocks, viz Jacquez, 101–14, 99 R, 143–B, 3306 C and Rupestris du Lot were taken. Apart from the affinity defects in 101–14 and 143–B mentioned in last year's report, no evident new affinity

defects were to be observed. The markedly lower crop and shoot weights of French, Saint Emilion, Canaan, Hanepoot, Semillon, Green Grape, Hebron, Temperanillo and Tinta das Barroccas grafted on 101–14 may, however, be an indication that these *V. vinifera* cultivars are not happy on 101–14 and that more serious affinity defects could develop later.

With very few exceptions the cultivars of the collection bore far smaller crops during the past season than during the 1970/71 season. This was particularly obvious in certain cultivars grafted on 99 R. This may be merely a seasonal phenomenon.

Determination of the viticultural and oenological qualities of cultivars in field trials – A series of 69 trial wines from red and white grape cultivars were prepared in duplicate during the past season. Grapes from the Nietvoorbij, Robertson, Lutzville, Constantia and Elsenburg Experimental Farms were used for this purpose. The wines were judged by a panel of 15 testers and points were allocated according to an adapted Vedel system.

White grape cultivars

When evaluating the white grape cultivars one should bear in mind that many of the cultivar wines come from very young vines and that too much reliance cannot yet be placed on the results obtained, especially as regards crop masses. All the cultivars at the Robertson Experimental Farm were bearing their first crop and therefore a large portion of the crop was broken off to allow the vines to develop fully. This also affected the quality of the wines.

On the basis of the results obtained the cultivar 7/4, an imported variety, surpassed all the well-known varieties at both Nietvoorbij and Robertson in the quality of the wine it yielded. Moreover, it has already produced a better crop (at a very early stage) than many of the well-known varieties. Green Grape, Colombard, Steen and Hanepoot were among the well-known cultivars that did very well and are still in the front rank. With one exception, therefore, there are no unknown or new cultivars that are better than the tried and trusted ones.

Red grape cultivars

Wine was also made from 15 red grape cultivars already being tested in small commercial vineyards. Here, too, the well-known varieties yielded the best results in the main. The cultivar Merlot, which cannot be classified as an unknown cultivar, but which is planted very little in South Africa, produced a surprisingly good and attractive wine and even surpassed Cabernet.

The quality of the wines made from Cabernet Sauvignon and Cabernet Franc was very much the same.

Although the figures do not reflect this (the Cabernet Franc vineyard is still very young) Cabernet Franc bears a lot better than Cabernet Sauvignon. The good results obtained with the cultivar 14/1 (imported) deserves special mention. This cultivar is very promising and could be an important addition to our red wine cultivars. The same applies to the cultivar 11/1, which is also imported.

Breeding and selection at the Research Station at Upington – A collection of various promising Hanepoot selections from the Summer and Winter Rainfall Regions was planted at the Upington Research Station in 1971. The collection included the so-called Both-Hanepoot and Rhodesian Hanepoot.

Of the crosses received from the Horticultural Research Institute at Roo-de-plaat some of the Keuka crosses seem promising in that their sugar content and flavour are exceptionally good. The Roo-de-plaat crosses are being multiplied together with new cultivars received from the Oenological and Viticultural Research Institute this season so that trial wines can be prepared from them.

The effect of drip and sprinkler irrigation on an established vineyard – During the 1971/72 growing season an observation pilot trial was carried out to investigate the effect of two different irrigation techniques, viz drip and sprinkler irrigation, on an established Steen vineyard with various training systems and planting widths.

During the growing season shoot growth, berry size and osmotic pressure were determined for the three training systems (bush-trained vines and slanting trellises 1,5 m and 3,0 m wide) at planting widths of 3,8 m x 1,5 m, with various irrigation methods.

On the whole the sprinkler-irrigated plots maintained a better rate of shoot growth than plots irrigated by the drip systems. Berry masses showed no clear-cut differences between the various treatments, and osmotic pressure was considerably lower on the sprinkler-irrigated plots than on plots where the drip irrigation system was applied. The crop data also show that the two methods of drip irrigation resulted in a lower crop mass throughout than where sprinkler irrigation was applied. Although no clear, fixed pattern can be deduced from the crop masses a 25 per cent higher yield on the average was obtained from the sprinkler-irrigated plots than from the drip-irrigated plots.

Cultivation and fertilising

Soil-preparation studies – The last Annual Report contained full particulars of the trial procedures, soil types, localities and other relevant background information in connection with this research.

The latest results of the Trial 1 section of the investigation are:

Nietvoorbij – Shoot masses determined in August 1971: No significant differences in respect of trenching depths, but significant differences in respect of the same two organic matter treatments that showed differences in the preceding crop season.

Crop masses determined in March 1972: No significant differences in respect of trenching depths or organic-matter treatments.

Owing to the fact that the results are still uncertain at this stage, it will be necessary to wait for the long-term results before any valid conclusions can be drawn.

Robertson – The shoot mass and crop data collected over three years indicate strongly that trenching depth and organic matter are having no significant effect on the Robertson trial.

The results of Trial II at Nietvoorbij and Robertson for the past three years may be summed up as follows:

Nietvoorbij – The shoot mass data collected over three pruning seasons and the crop data collected for the first time after the 1971/72 growing season were processed statistically and the most important conclusions may be summarised as follows:

The three deep trenching treatments did best and were significantly better than the ripping treatment and the shallow ploughing treatment.

No significant differences between the ripping treatment and shallow ploughing treatment could be demonstrated.

Furthermore, no significant differences could be shown between deep trenching with organic matter and deep trenching without organic matter. This indicates that the two sources of organic matter, viz chaff and sawdust compost, had no significant effect on shoot mass and yield at the rates applied and where the material was applied up to a depth of 120 cm.

Robertson – The shoot mass and yield data collected over three years were processed statistically and the chief conclusions are briefly as follows:

No significant differences between any of the treatments could be demonstrated as regards crop mass in March 1970, shoot mass in July 1970, crop mass in March 1971 and shoot mass in July 1971.

The yield data of March 1972 showed that the deep trenching treatment without organic matter and

the deep trenching treatment with 1 751 bales of chaff per ha (which produced the highest yields) were better to a statistically significant degree than the shallow ploughing treatment (which produced the poorest results). No significant differences could be demonstrated between the deep trenching treatments without organic matter and those using 1 751 bales of chaff per ha and 80 m³ of sawdust compost per ha.

Furthermore, no statistically significant difference could be shown between the shallow ploughing, ripping and deep trenching treatments using 80 m³ of sawdust compost.

There are indications that the depth of root growth is limited by the depth of soil preparation. This could have a long-term effect on the various treatments and it is therefore necessary to evaluate the trial over a long period.

Tillage studies

From the statistically planned tillage trial laid out at Nietvoorbij it was possible this year to get an indication of the effect, on yield alone, of the various cultural practices applied for only two growing seasons.

In terms of yield the straw mulch (which produced the best yield on the average) and the deep lister treatment (with the second highest yield) were the best. No significant difference between the two treatments could be demonstrated. The straw mulch was significantly better than the shallow lister, weedkiller, clean cultivation and bush-slashing treatments.

The bush-slashing treatment produced the lowest yield and was significantly poorer than the straw mulch and deep lister treatment. However, no significant differences between the bush-slashing, shallow ploughing, weedkiller and clean cultivation treatments could be demonstrated in spite of the fact that the average yields differ considerably.

A cost-income benefit comparison of the various cultural practices was made, on the assumption that some form of cultural practice is always applied. In this comparison the shallow lister treatment was regarded as a standard practice for the soil type and all profits or losses on yield and reduction or increase in costs for the various cultural practices are calculated relative to the yield and costs for the shallow lister treatment.

It appears from the calculated net profit or loss that only the deep lister and weedkiller treatments have economic advantages in comparison with the shallow lister treatment, with the bush-slashing treatment producing the biggest loss and the straw mulch treatment the second biggest loss in relation to the shallow lister treatment.

Fertilising

The uniformity studies carried out in this trial at the Nietvoorbij Experimental Farm before fertilising treatments were applied showed that the trial as originally planned would not meet the requirements, because of the uneven quality of the soil. On the basis of the results obtained from these studies, a more suitable statistical design was therefore decided on. The number of trial vines to be used for measurement was also reduced so that better control of the trial material would be possible and more accurate measurements could be ensured.

The fertilising treatments will be started before the beginning of the 1972/73 growing season. At present the whole vineyard is receiving only nitrogen fertilisation in the form of about 200 kg of limestone ammonium nitrate per hectare per year and wine of outstanding quality is being made from these grapes. Therefore even if all that is possible is to establish the effect of various nitrogen treatments on wine quality, this trial will, to a great extent, achieve its object.

Diseases and pests

Phylloxera

Index values of various populations of phylloxera are determined and compared in order to distinguish morphological strains. During February 1969, November 1969 and February 1972 phylloxeras were collected from the Stellenbosch and Vredendal areas and index values were determined. During February 1969 and 1972 phylloxeras were also collected in the Uppington area. The 1969 results showed that the phylloxera populations of the Stellenbosch and Uppington areas were morphologically different from those of the Vredendal area and that no differences occurred in the same population over a period of nine months. The 1972 results, however, showed that the populations of these three areas did not differ from one another and that significant differences in the same population could occur over a period of three years. Although morphological differences may occur between phylloxera populations from different geographical areas, they do not remain constant. So distinguishing morphological strains has no practical application.

In order to determine whether the strain in the Vredendal area is biologically different from the Stellenbosch strain, 10 different rootstock cultivars were planted in an infected vineyard in the Vredendal area in July 1972. At this stage the vines are still too young to produce any results, but rootstock trials showed that *Rupestris du Lot*, *Metallica* and *Jacquez* are attacked in both areas. These cultivars therefore supply no proof that biologically different strains occur in the two areas.

It was also found that 143-B was attacked in the Stellenbosch trial but not in the Vredendal trial. The opposite was found in the case of 333.

No certain conclusions can be drawn at this early stage, but it appears that 333 and 143-B may be valuable in distinguishing biological strains.

Resistant rootstocks — In the Vredendal area the O.V.R.I. is conducting a rootstock trial to obtain the best rootstock cultivars, on the basis of vigour and production, for that area. The same trial may also be used to identify the best cultivars for that area on the basis of resistance to phylloxera.

It was found that the resistance to phylloxera of Jacquez, 333 and Metallica were significantly less resistant to phylloxera than Richter 99, Richter 110, Salt Creek, Rupestris du Lot, 101-14, 143-B and 3306.

The vines in this trial are only four years old and further observations are therefore needed before definite recommendations can be made. However, it is provisionally recommended that Jacquez, 333 and Metallica should not be used as rootstocks in the Vredendal area.

Chemical control — In September 1971 the following preparations were applied in a vineyard in the Vredendal area that was severely infested with phylloxera: disulfoton and Nemacur at doses of 50 and 25 kg per ha each and C-46 (hexachlorobutadiene) at a dose of 250 kg per ha. The first two preparations were broadcast in granular form and worked into the soil, and C-46 was applied as a liquid with the aid of manual soil fumigation pumps.

The degree of infestation was determined in January 1972. It was found that disulfoton at 50 kg per ha, was significantly better than disulfoton at 25 kg per ha, Nemacur at 25 and 50 kg per ha and the control.

However, this treatment did not kill all phylloxera individuals on the roots and is therefore not considered successful. There was no evidence that the Nemacur treatments were better than the control. However, C-46 was significantly better than the control and all the other treatments and killed all the individuals on the roots.

So it can now be accepted that C-46 kills phylloxera, but further observation is needed to determine how long it remains effective.

When crop masses were obtained in February 1972 no significant differences between the treatments and the control were found. Improvements in growth and yield are only expected during the next two seasons.

In November 1971 a survey was carried out in the Upington area to determine whether phylloxera infestation has any connection with growth arrestment disease. Five vineyards classified as "diseased" on account of growth arrestment and two classified as "healthy" in 1971 were inspected. A vineyard that was diseased in 1970 but healthy in 1971 was also inspected.

Of the diseased vineyards, two were very severely infested with phylloxera and three were not infested. One of the healthy vineyards was severely infested, and the other was not infested. No infestation was found in the diseased/healthy vineyard. These eight vineyards were inspected again in January 1972 and the same results were obtained.

So there is no direct connection between growth arrestment disease and the presence of phylloxera.

Phytophthora cinnamomi

The sudden death of vineyards, chiefly young vineyards, grafted on R99 has been reported from time to time over the past few years. In 15 cases the occurrence of the fungus *Phytophthora cinnamomi* on the roots of affected vines was confirmed and there are strong indications that it was the primary cause of the death of the vineyards.

The cases investigated occurred on a variety of soil types and in various localities. So far the following are the most interesting discoveries made:

- *Phytophthora* occurs chiefly on the rootstock R99. A few infections on Rupestris du Lot and R110 were also confirmed but there were no infections on Jacquez and 101-14.
- In no case was the infection found on vines older than 6 years.
- It was established that the fungus was present in a few vine nurseries and could spread from there.

Growth arrestment disease along the Lower Orange

An investigation carried out on about 280 farms and including random sampling of all the vineyards of the Lower Orange showed that 25,5 per cent of all sultana vineyards were subject to growth arrestment disease during the 1971/72 season. The percentage incidence was as high as 65 in some years. On the basis of expected climatological and other differences the Lower Orange area was divided into five subareas for the purpose of the investigation, viz Kakamas, Upington, Keimoes, Gariep and Groblershoop.

The crop masses taken from 112 diseased blocks, 81 diseased/healthy blocks and 94 healthy blocks were 9,8, 36,1 and 22,9 tons per hectare respectively. It

appears that vines that had been diseased earlier, but were apparently healthy in the season during which they were examined (disease/healthy), later made up their lower crop masses.

The symptoms of the disease were successfully described for the first time. The number of active growing points, average length of new growth at a given time, incidence of black bunches, shiny leaf spots and the degree of millerandage may be accepted as a reliable basis for the description of symptoms. There was a highly significant positive correlation between incidence of the disease and shoot mass, and a negative correlation between incidence and crop mass.

So far the investigation has shown that the following factors probably play no part in the occurrence of the disease:

1. Methods of preparation such as the levelling of blocks and crops (lucerne and/or cash crops) that preceded the vineyard.
2. The origin of the planting material.
3. Mites — with the exception of *Eriophyes vitis* (Pgst.) which was found in the buds of the shoots of disease, healthy and diseased/healthy material, no harmful mites were found on shoots, roots and leaves.
4. Phylloxera. Although infection was found, there is no pattern to the incidence of Phylloxera in diseased and healthy blocks.
5. Eelworm. Populations were very high in some cases, but not noticeably higher or lower in diseased or healthy blocks.
6. Fungi and bacteria. Shoots, leaves and bunches of diseased as well as healthy material were investigated. No pattern was found; the same species of fungi were present on both types of material.
7. Anatomical abnormalities of the roots.
8. Composition of ripe grapes.
9. No significant differences between diseased and healthy vines (280 different plots) with regard to the occurrence of roots and root spread. At certain depths the healthy group of vines had more roots but at other depths the diseased group had more.
10. The length, breadth and slope of the irrigation beds of the diseased and healthy blocks do not differ significantly. This finding is unexpected, since the construction of irrigation beds was thought to play an important part.

About 1 200 soil samples, taken at three to four horizons from all parts of the area being investigated and representative of diseased, healthy and diseased/healthy blocks, were analysed for pH, resistance, silt, clay, fine, medium and coarse sand, zinc, sodium, phosphorus, potassium, calcium and magnesium and 120 samples were analysed for manganese.

The results of the analysis in the Groblershoop area have already been statistically processed. The following pointers emerged:

There were *no* significant differences between diseased and healthy blocks with regard to potassium, sodium, calcium and magnesium at any depth. This finding does *not* agree with the results of previous analyses, which did indicate such differences.

The fact that the silt and clay content of diseased plots is significantly higher than in healthy plots agrees with virtually all previous results.

Measurements of soil strength at various horizons show that the soil strength is higher in the diseased plots. This supports the theory that soil physical factors play a part in the incidence of this disease.

About 580 green matter samples, taken from blocks of the three disease categories throughout the area were analysed for phosphorus, potassium, sodium, calcium, magnesium, zinc, copper, manganese and iron. The following facts emerged:

The calcium and magnesium contents are significantly higher in the case of the diseased vineyards, and the potassium content is lower.

Virtually all trace elements are present in significantly larger quantities in the diseased vineyards.

The results of previous series of leaf analyses agree with the latest findings in all respects.

In the diseased blocks the rows were significantly further apart and the vines planted further apart in the row. The spacing was 3,3 m by 1,8 m for diseased blocks and 3 m by 1,7 m for healthy blocks. On the basis of these distances there are an average of 450 more vines per morgen in healthy blocks than in diseased blocks. The finding that the espacement in healthy blocks is so much denser may be connected with shading of the soil surface.

It is clear from the survey that the percentage incidence of growth arrestment disease from year to year varies from 25 to 65 per cent. Moreover, it was established from crop masses measured on about 280 plots that the disease can cause annual crop losses of 60

per cent or more. It is conservatively estimated, therefore, that this disease causes an annual loss of more than R1 000 000 to the industry.

Downy mildew

This disease again occurred fairly generally in the vineyards of the Western Cape but was not as widespread as it has been for the past few years.

Warnings, based solely on meteorological data, apparently led to heavy expenditure on spraying programmes, and sometimes intensive spraying, which could not always be justified in terms of the actual incidence of the disease.

Although meteorological data were effectively used during the past season, warnings were confined to specific areas where outbreaks had been confirmed in the early stages. This procedure worked very well and undoubtedly helped to save a lot of money.

Wine chemistry

Determining the degree of ripeness for pressing

It has always been accepted that quality wine cannot be made from grapes pressed under 20°B. Last year, however, grapes harvested at 15°B produced excellent Stein wine at Nietvoorbij after skin contact and de-acidification to 7 g of total acid per litre by means of a technique that is widely applied in Europe.

This year Steen grapes were again harvested periodically at Nietvoorbij and at Robertson and wines were made at sugar contents that varied from 15°B to 22°B, with the aid of skin contact and partial de-acidification. In these cases Steen grown at Nietvoorbij started to produce good wine only at 17°B. The best wines were obtained from grapes at 20°B. However, with a further rise in the sugar content the quality of the wine dropped. It appears that the lowest sugar content at which quality wine can be obtained after skin contact and de-acidification does not remain constant from year to year.

In contrast with the grapes from Nietvoorbij, the Robertson grapes produced good wines even at 14°B, after skin contact and de-acidification. With a higher sugar content (16°B) the quality rose even further. Grapes with higher sugar contents did not produce good quality wine after skin contact. Wines as good as those pressed at 16°B (with skin contact and de-acidification) were obtained from free-drained must from grapes at 21°B.

In order to reduce the relatively long period of skin contact (24 hours) and make the method more practicable, a four-hour period of stirring was included.

The results, compared with those obtained with the longer period, were not so reliable as far as improvement in quality goes.

The purpose of this study was to investigate the effect of the year and the area on the optimum degree of maturity for Steen grapes for the making of light quality wines of character. Owing to the long skin contact period required and the relatively complicated de-acidification technique, this procedure will not readily be accepted by wineries. The process could, however, have other advantages such as the production of a light, flavoursome white wine and the extension of the harvesting season. This could justify further investigation in order to develop and refine these techniques.

Increasing the percentage of good wine that can be recovered from must — A survey of problems experienced by co-operative wineries showed that the great loss of good wine that results from the removal of the thick must sediment using present techniques is of the greatest importance.

A preliminary investigation of must mixtures derived from the cultivars French and Green Grape with a natural acid content that has been increased, was carried out in co-operation with the K.W.V. at Riebeeck Kasteel and Robertson to determine whether —

- the must needs to settle if good wine is to be made
- the clearer top layers of normally settled must will produce better quality wine than the lower, more turbid layers.

The Riebeeck Kasteel samples all gave wines of a very poor quality and no conclusion could be drawn. The samples from Robertson, however, clearly showed that if the must is allowed to settle in the normal way, the degree of clarity of the must does not affect the quality of the wine to any significant extent. On the other hand the wine made from unsettled must, with or without the addition of acid, was consistently of very poor quality (distilling wine). This clearly showed that good wine cannot be made unless the must is allowed to settle.

Oenology

A total of 306 experimental wines were made in the research winery at Nietvoorbij during the 1972 season. This year for the first time all experimental wines were made in duplicate for purposes of statistical processing.

In addition to the making of experimental wines as part of the evaluation of cultivars, experimental wines were made from grapes from most of the cultivation trials and other experiments.

Colour extraction in red wines — Heat-extracted wines made in 1971 and their controls made in the conventional way were matured in 140-litre Nevère oak casks during the past year. Some wines were left in wooden casks for only six months and then bottled, and others were bottled after 12 months. The wines were then compared with those that were matured only in bottles.

Red wines of the cultivars Tinta das Baroccas and Cabernet Sauvignon made by heat-extraction showed a considerable improvement in quality after twelve months' bottle-aging.

The cultivars Shiraz and Zinfandel, on the other hand, produced better heat-extracted wines after six months' of aging in wood than after bottle-aging only.

All wines showed an improvement in quality after they had been aged in wood for a time in comparison with those that underwent no aging either in the bottle or in wood.

The reaction of certain cultivars to skin contact treatment

To date, skin contact treatments have been applied mainly to Steen and Riesling grapes. Although it was found with these cultivars that good, healthy grapes are one of the chief requirements for the successful application of the skin contact treatment, it was necessary to investigate the effect of the cultivar as well. During the 1971 experimental year the skin contact treatment was tested on various white wine cultivars by the Department of Oenology of the University of Stellenbosch.

For the cultivars Steen, French, Colombard and Green Grape there were no notable differences in quality between wines made from drained must and those made from skin contact must. However, in the case of Sauvignon Blanc and Riesling the wines made from the drained musts were better than those made from skin contact musts.

In previous years the effect of skin contact on quality with Riesling grapes was similar, although the opposite effect was also sometimes observed. Whenever the 1971 wines made with skin contact tasted slightly rough and astringent, they were treated with PVP. This applied to wines made from Steen, Sauvignon Blanc and Green Grape.

Several years' experience of skin contact seems to indicate that any cultivar wine can benefit from the treatment. What is of fundamental importance is the health of the grapes and the protection of such wines against oxidation, and treatment against excessive

astringency by clarifying with PVP when necessary. Wines made with skin contact are generally fuller-bodied than wines made from free-drained must.

Prevention of browning

The deliberate oxidation of the must before fermentation as a method of preventing browning was investigated. This drastic treatment of the must had been very successful in the past in that the wines made from such must were exceptionally resistant to browning and not really inferior in quality to wines made by the control treatment. However, the practice was confined to skin contact musts.

In 1971 free-drained must was treated in this way, in addition to Riesling skin contact must. Sensitivity to browning in wines made from oxidised must was again far lower than in those made from unoxidised must. The wine made from the oxidised skin contact must was not only poorer than that made from unoxidised skin contact must, but also poorer than that made from oxidised free-drained must. Wine made from oxidised free-drained must was unanimously preferred to wine made from unoxidised free-drained must by a panel of thirteen judges.

It appears that the concern of winemakers to prevent oxidation in grape juice prior to fermentation may to a certain extent be exaggerated.

Wine Microbiology

Formation of hydrogen sulphide and sulphur dioxide during fermentation — The formation of hydrogen sulphide (H_2S) by yeasts during the fermentation of grape juice and its subsequent presence in the wine is causing the wine industry great concern. At the same time the formation of sulphur dioxide (SO_2) which is an intermediate product of the H_2S synthesis can cause problems in rebate wine-making, where SO_2 may not be used.

Therefore, to start with, 200 yeast strains were screened in order to assess those which form high amounts of either H_2S or SO_2 . Since the H_2S content of a fermenting broth decreases towards the end of its fermentation, these screening tests did not reveal any strain forming particularly high amounts of H_2S . It could, however, be established that about 10 per cent of the strains form amounts of SO_2 varying from 40 to 100 mg per l, which by far exceeds the maximum concentration a rebate wine may contain and confirms results similar to those obtained in Switzerland, Germany and Australia.

Since all the strains were capable of forming 2 to 3 times as much SO_2 in a plain synthetic medium as in the

complex must, it was assumed that the formation of SO_2 was possibly influenced by the substrate, particularly by its methionine and cysteine content.

Therefore fermentation tests were conducted to establish the influence of these two sulphur containing amino acids on the SO_2 formation of two normal and three so-called SO_2 -forming yeast strains. It could be demonstrated that the addition of both methionine and cysteine to either must or the synthetic medium reduced the SO_2 formation by up to 90 per cent in comparison with untreated controls.

These results necessitated determinations of the amino acid contents of various musts in order to predict an irregularly high SO_2 formation in rebate wines — a low content of these amino acids means that more SO_2 and a high concentration meaning that less SO_2 would eventually be formed. These analyses are still in progress.

Furthermore the question arose to what extent the uptake of sulphate from the must by normal and SO_2 -forming strains was dependant in the first instance on the amount of SO_2 that can be formed by a specific strain, and secondly on whether methionine and cysteine in reducing the SO_2 formation would eventually decrease the consumption of sulphate. (SO_2 is the first intermediate product of the sulphate reduction, and H_2S the last, necessary for the synthesis of sulphur containing compounds in the cell.)

It could be shown that SO_2 -forming strains consume twice as much sulphate as normal yeasts. On the other hand the addition of both methionine and/or cysteine to the substrate decreased up to a third the sulphate uptake in comparison with untreated controls. This consequently caused less SO_2 formation. Further evaluations concerning the formation of H_2S under these conditions are being carried out.

The results so far obtained clearly demonstrate to what extent SO_2 and H_2S formation may be influenced by the composition of the must. There are strong indications that as far as SO_2 and H_2S formation are concerned the composition of a must differs considerably with grape variety, soil and vintage. Some work on these aspects is already in progress.

The effect of fungicides on H_2S formation — During the last few years the use of fungicides in vineyards against botrytis, oidium, plasmopara and phomopsis has increased. In relation to this there have been more and more complaints about H_2S formation during fermentation, as well as about the start of a fermentation which might be delayed for several days. To assess this three different spray programmes were applied to a vineyard of the Pinotage variety. The first treatment was given twelve weeks before the harvest. Program No. 1 stopped six weeks, No. 2 three weeks and

No. 3 only one week before the grapes were harvested. The fungicides used were bordeaux, captan, copperoxychloride, copperoxychloride + zineb, dichlofluanid, folpet, mancozeb, maneb, propineb, TMTD and zineb.

The determination of H_2S in the fermented samples clearly showed that the fungicides containing copper caused higher H_2S formation, especially copperoxychloride. The effect of bordeaux was less critical since it contains only 10% copper, whereas copperoxychloride contains 50%.

Furthermore it became evident during the fermentation of the samples and after laboratory tests where 0,5 and 1,0 mg per litre respectively of the fungicides folpet, captan or dichlofluanid had been added, that these fungicides can delay the start of fermentation for several days.

To prevent H_2S formation caused by copper-containing fungicides no spraying should be done less than 8 weeks before harvesting. To avoid any delay in the start of fermentation, captan, folpet or dichlofluanid treatments should not be applied later than 6 weeks before harvesting the grapes.

Under the climatic conditions of the Western Cape it seldom rains during summer and harvest time. It is therefore possible that residues of fungicides stay on the skins of the berries and get into the juice during pressing or fermentation on the skins. If any residues are likely to occur the must should be better clarified than usual. A bigger inoculum of pure yeast, up to 5 per cent, can also help prevent delays in fermentations.

Furthermore the concentrations of certain heavy metals, viz manganese, copper and zinc that may cause increased H_2S formation were determined, with special regard to the use of fungicides containing these trace elements. A modified ashing technique was developed in order to facilitate the direct ashing of must samples.

It could be demonstrated that all copper-containing fungicides significantly increased the copper content of the must. The Zn-containing fungicides like zineb, slightly increased the zinc-content of the samples, whereas mancozeb and maneb, which contain manganese did not raise the concentration of manganese in the grape juice.

Sultanas, currants and raisins

Sultanas

The total production of sultanas has risen by about 3 000 tons since 1966 and is 11 450 tons for 1972.

The relative profit advantages of wine grape production in the recognised sultana areas further emphasised the need for greater efficiency in this industry. The selection and multiplication of highly productive clones is one aspect that enjoys high priority. Promising selections are already being multiplied at the Upton Research Station, and selection has been started at Lutzville. The virus purification of promising selections by means of heat treatment has also been started.

Bud analyses for crop forecasts and extension on pruning methods were continued. The average fertility of the Orange River area for various years may range from 30 to 60 per cent, and is 50 per cent for the current season.

Currants and raisins

Currant production is still showing a gradual drop and in 1972 it was only 707 metric tons, with the result that considerable quantities had to be imported to supply the local demand. This is hard to explain, particularly in the Olifants River area where currant production is very profitable.

The Oenological and Viticultural Research Institute is already helping the Dried Fruit Board to obtain and multiply promising selections. It is envisaged that research on suitable training methods will be undertaken.

The production of raisins dropped by 684 tons after 1966 to only 776 metric tons in 1971. The 1972 production is 1 242 tons. It is important that production of this product should be maintained. At present the first priority seems to be to obtain Hanepoot types with fleshier berries and fewer seeds. These qualities are considered in selection programmes and in importing material. Promising Hanepoot crosses observed in overseas collections have already been imported.

Inspection services

The provisions of Act 25/1957, which deals with the manufacture, local sale and import and export of wines, other fermented beverages and spirits, are applied by the liquor control division of the Department, which has its headquarters at the Oenological and Viticultural Research Institute.

Amendment of Act 25/1957

Certain principles regarding the production and marketing of wines of origin, the prescription of grape cultivars for purposes of wine-making and an embargo on the use of false or misleading descriptions for liquor in general were laid down in 1970 in terms of Act 25/1957. Owing to certain developments overseas that affect our export market, and to representations

subsequently made to the Department by certain sections of the local industry, it has since appeared necessary to extend the protective measures mentioned above.

The chief reasons for this state of affairs were the early finalisation of the European Economic Community's regulations for the common wine market, and more specifically the earlier entry of the United Kingdom to Euromart, as well as the insistence of local producers on further protection for the production and marketing of estate wines.

The Wine, Other Fermented Beverages and Spirits Act, 1972 (Act 62 of 1972), and the regulations published in *Government Gazette* 3569 dated 16 June 1972, contain the following main provisions:

Firstly, strict control measures relating to the use of the names of grape cultivars and the indication of the year of manufacture on wine labels are laid down.

Secondly, wider powers are created for the demarcation of prescribed production areas for wine and spirits and the registration of farms for the production of estate wines. Briefly this means that more specific conditions have been laid down for wines or spirits if they are to be sold under the name of an area or farm, or with an indication of the grape cultivar from which they were derived or the year in which they were made. The Wine and Spirits Board has been specially empowered for the application of these requirements, including the setting of minimum quality standards for such liquor and the certification of all such liquor.

Thirdly, a new set of regulations was published in June 1972 (Government Notice R.1010 dated 16 June 1972) to make provision for stricter control over all liquor imported into the Republic, in view of the fact that the provisions of Act 25/1957 also apply to imported liquor offered for sale on the domestic market. These regulations come into operation with effect from 1 December 1972 and replace the previous system in terms of which tests were carried out on imported liquor only sporadically.

Fourthly, the list of grape cultivars that may be used in future for making wines intended for drinking was published by regulations (Government Notice 124 dated 4 February 1972). This restriction does not apply to distilling wine.

A summary of the activities of the Division, with special reference to the number of samples handled for various purposes during the year under review, follows.

Screening and certification of export liquor

The strict screening on the basis of quality and chemical composition of all export liquor and the

certification of such liquor by the Wine and Spirit Board in terms of the liquor export regulations was continued.

In the category of liquor exported in bottles under a South African label 1 472 samples representative of 19 244 hectolitres of liquor were inspected. Of these 1 451 samples (98,5 per cent), representative of 19 183 hectolitres (99,8 per cent), were certified suitable for export.

Here it may be mentioned that 17 per cent more bottled liquor was exported this year than last year. This increase is due chiefly to rises in exports of unfortified and sparkling wines, which constituted 44,6 per cent and 25 per cent respectively of the total.

With regard to the export of wine and brandy in bulk, 443 samples representative of 103 996 hectolitres, were inspected. All these samples were certified for export. Bulk exports were 6,0 per cent higher this year than last year. Bottle and bulk exports together rose by 7,6 per cent during the year under review. This retention of the export market in very difficult circumstances should be regarded as an encouraging sign.

Screening and certifying wine spirit

The first responsibility of the Government Brandy Board is the quality screening of all spirit obtained by distilling wine by means of a rectifier. Secondly all wine (so-called rebate wine) intended for distilling in a pot still to brandy (known as rebate brandy) is evaluated for quality and certified suitable for that purpose, and the new distillate obtained in that way has to be certified suitable for aging in wooden casks under excise supervision for at least three years, after which the distiller is entitled to a rebate on excise tax, hence the name "rebate brandy".

Further rebates are granted if the distillate is matured for a further four or five years. By law none of these distillates of wine may be used for any drinking purpose, i.e. for fortifying wine, manufacturing brandy, gin, liqueurs and vodka or for drinking as such, before the distillate has been screened and certified by the Brandy Board.

The following numbers of samples (with the volume they represent given in brackets) were inspected during the year: rebate wine – 1 295 samples (512 493 hl), 287 samples (93 403 hl) of which were rejected; rebate brandy – 493 samples (101 873 hl), 45 samples (6 971 hl) of which were rejected; spirits – 889 samples (279 346 hl) 40 samples (10 847 hl) of which were rejected.

In addition 13 samples of so-called low-strength wine spirit (2 869 hl) were inspected by the Board and 2 samples (394 hl) were rejected. This type of wine spirit

is distilled for a specific purpose, viz the fortification of certain types of wine and is therefore judged as a separate class.

A third class of wine spirit submitted to the Brandy Board is the so-called raw spirit, which is a preliminary distillate from distilling wine concentrated in this way chiefly to reduce its volume and so save on transport costs and eliminate the construction of expensive stills by distant co-operative wineries. Naturally, therefore, the product is impure, and it is intended for re-distilling to pure spirit, but by law it is officially certified unfit for use at the raw-spirit stage. In all 172 samples (52 803 hl) of raw spirit were certified in this way.

Inspection of licensed premises

Liquor inspectors appointed under Act 25/1957 travelled 53 378 kilometres during the year under review, inspected 1 123 licensed premises in the Republic and tested 65 344 bottles of liquor. At 48 of these premises 281 samples that appeared suspicious according to the inspectors' preliminary tests were submitted in terms of the Act for chemical analysis by an official analyser. The result was that 16 licence holders were charged with selling understrength liquor. Four persons were convicted and fined, and admissions of guilt were accepted by the court in two cases. In four cases the accused were found not guilty and six cases are still pending.

In the case of 16 less serious offences warnings were issued to holders of hotel and bottle store licences and to manufacturers.

Routine chemical analyses

Officers at the chemical laboratory of the liquor control division are official analysers of liquor in terms of Act 25/1957. In addition to all the analyses done under this Act the laboratory also serves as a centre for the analysis of liquor on behalf of other Government departments such as the Police and the Department of Customs and Excise.

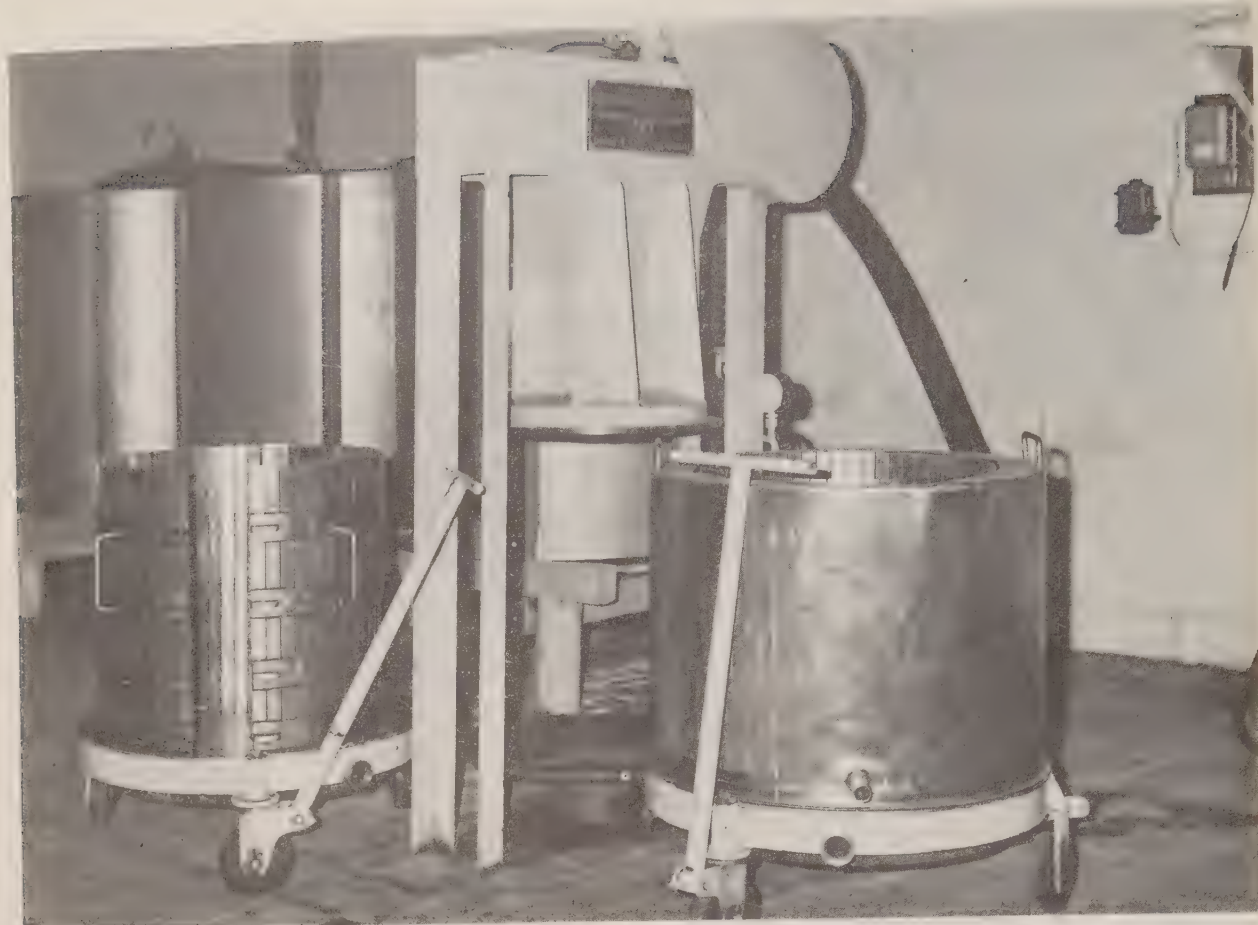
The following is a summary of the number of samples analysed by this laboratory during the year, with an indication of the various purposes for which analyses were carried out.

Analysis	Number of samples
Consignments of export liquor analysed in terms of the Liquor Export Regulations .	2 439
Consignments of export liquor analysed for the issue of special analysis certificates . .	164



Liquor in hotels is regularly examined by experts

Consignments of import liquor analysed under Act 25/1957	257	Experimental liquor on behalf of the Oenological and Viticultural Research Institute	1 384
Liquor inspectors' samples analysed under Act 25/1957	281	Analyses for farmers and other private bodies and persons	54
Potassium ferro-cyanide in wines in terms of regulations under Act 25/1957	4	Total	5 828
Sparkling and perlé wines analysed for the purposes of Customs and Excise	1 214	Vine nurseries (Western Cape)	
Liquor submitted by the S.A. Police for analysis under the Liquor Act	13	The numbers of vine nurseries registered over the past three years were:	
Liquor for special analysis on behalf of the Government Brandy Board and the Wine and Spirit Board	18	1969/70	322
		1970/71	334
		1971/72	338



Apparatus used in the small-scale preparation of experimental wines

The number of registrations remained fairly constant over that period. However, a considerable increase is expected in the near future because of the allocation of enlarged quotas to producers by the K.W.V. and the establishment of the wine industry outside the traditional wine-producing districts (particularly in the Orange River complex).

The following numbers of grafted vines, rooted tame vines and rooted rootstocks were available at the

various vine nurseries during the past season:

Grafted vines	=	10 739 550
Rooted tame vines	=	1 218 010
Rooted rootstocks	=	7 977 000

The following table gives the number of grafted vines of the more important table and wine grape varieties as well as rooted rootstocks in registered nurseries (1971/72 season).

Wine grapes		Table grapes		Rootstocks		
Cultivar	Number	Cultivar	Number	Cultivar	Rooted	Cuttings
Steen	4 387 070	Barlinka	197 080	Jacquez	2 372 200	2 202 333
French	1 453 010	Waltham Cross	77 600	101-14	3 189 350	1 076 333
Hermitage	911 780	Alphonse L.	68 220	Richter 99	2 138 200	1 546 000
Cabernet	639 020	New Cross	37 750	143-B	117 600	126 333
Hanepoot	592 190	Queen of the V.	32 300	Matalika	79 600	127 000
Colombard	563 775	Almeria	30 875	Salt Creek	66 150	10 000

Selection of disease-free sources of graftwood

The announcement that the first selected vine material (second phase material) would be made available to the nursery industry this season was received with great satisfaction by nurserymen and other interested persons. Only rootstock material will be released this season.

The following selected material will be released:

Cultivar	Number
101-14	32 000
Richter 99	30 000
143-B	4 000
Richter 110	1 000
Metalika	6 000

The establishment of foundation blocks in the most important wine-producing districts will proceed under the control of the nursery associations concerned.

The nursery associations were drawn into the scheme in an attempt to stimulate enthusiasm among their members and because the associations can be of assistance by keeping an eye on the foundation blocks and accepting responsibility for them.

CITRUS

Citrus production is expected to continue to rise in the Eastern Transvaal. When the Tzaneen Dam has been completed there will be a reliable water supply in that area and an increase in production of about 40 per cent is expected in the vicinity of Tzaneen. The Letaba district has 2 000 000 trees and supplies 20 per cent of the Republic's entire citrus crop.

Producers in the Rustenburg and Brits districts have had a bad season.

Although prices were higher in general, devaluation meant that citrus farmers did not benefit much. Exports to Japan continued, but were not entirely satisfactory owing to a lack of fruit that complied with the required standard.

During the year under review the total production of oranges was about 207 500 cases less than during the previous year and tree numbers dropped by 4,1 per cent.

Calculated according to the number of trees, the average yield per tree was 2,4 big boxes, and the average yield of fruit of export quality was 1,2 cases per tree.

During the past season 833 100 trees were available in registered nurseries, most (603 900) in the Transvaal, followed by 159 100 in the Western Cape.

Breeding and selection

Eighteen treatments to determine the pollination requirements of the promising loose - skin cultivar, the Minneola tangelo, showed that this cultivar is self-incompatible and that its ability to produce fruit by means of self-pollination is poor. It is also cross-incompatible with its sister cross, the Orlando tangelo.

After cross-pollination with most of the pollen sources there was a great increase in fruit set. The fact that this hand cross-pollination test has shown that certain of the promising loose-skin cultivars are effective pollinators of the Minneola is encouraging. However, the seed content was exceptionally high throughout, which could be a major problem in the commercial application of this finding.

Both overseas findings and limited local information seem to indicate that the Minneola, like the Ortanique, is a promising loose-skin cultivar for the South African citrus industry.

Ortanique, a word derived from *Orange-tangerine-unique*, is a natural sweet orange x maartjie cross discovered in Jamaica early this century. Because of the popularity of Ortanique on various overseas fresh-fruit markets, large-scale plantings of this cultivar were made in Jamaica.

The Institute was fortunate in being able to make use of a commercial Ortanique orchard in Swaziland. Fifteen treatments were applied in the spring of 1971.

A large number of cross pollinations have already been carried out at the Citrus and Subtropical Fruit Research Institute. Owing to the high percentage of nucellar embryony, a relatively small number of crosses have been obtained so far.

The evaluation of 179 established trifoliate crosses has been started. These trees are in full bearing and value determinations were carried out in respect of the production of the tree, seed content, seed germination and poly-embryony. In the case of the most promising crosses further evaluation of these tests is being carried out.

Attempts are being made to obtain cuttings for rootstocks in order to ensure that the rootstock material is genetically identical to the crosses on which the value determinations are being carried out.

Rootstock studies

A comprehensive series of rootstock studies has been planned for the entire country. The trees are being produced at the Sundays River Research Station at Addo and then distributed to the various regions.

It has been found at the Messina Experimental Farm that cutting the rootstocks off has decided advantages, especially in the case of the Troye citrange. Although the number of thorns that sprout on the shoot does not decrease after cutting, the number of thorns per unit of length is considerably lower, which makes budding on the shoot of a rootstock that has been cut off easier. If rootstocks become too thick before budding, young rootstocks that have developed after the cutting operation may be successfully budded.

The trial is being repeated with considerably more combinations of cultivar rootstocks.

Virus-free material

During the year under review the work originally planned with regard to the production of virus-free material was continued. About 60 cultivars (more or less 4 000 trees) were planted in the orchards in August 1971 and seed from an additional 30 cultivars was sown in beds.

The Comprida citron, the Mexican lime, and a few lemon and naartjie selections have already begun to bear. Canning factories were not satisfied with the limes and citrons sent to them to try out, but were prepared to analyse additional samples.

According to a virologist there are no visible signs of virus infection in these citrus trees.

Cultivation and fertilising

The results of a fertilising project at Nelspruit show that the optimal quantity of nitrogen a citrus tree requires for high production and good quality fruit is fairly critical. The project lasted for 13 years and Valencias were used. The results may be of great importance to the citrus industry.

The aim of the project was to establish the optimal quantity of nitrogen that should be applied to a citrus tree under Lowveld conditions if good yields are to be produced without any adverse effect on the quality of the fruit. Research has also determined whether one application of nitrogen in July as against spreading the same quantity over three treatments, viz in July, December and March, made any difference to the yield and quality of the fruit.

It was found that with low nitrogen applications production is very low, although the fruit is bigger with thinner peels. On the other hand, if the applications are too heavy the yield is also reduced and the fruit is smaller with thicker peels. In addition the increased levels of nitrogen showed a strong tendency to increase the acid content of the fruit.

The nitrogen content of eight-month old leaves, sampled from branches bearing fruit, is very critical and there is a definite relationship between yield and the percentage of nitrogen in the leaves. The maximum yield was obtained with 2,45 per cent of nitrogen in the leaves. Above this value even a slight increase was accompanied by a considerable drop in yield.

It was also proved that when Valencias received a single application of nitrogen during July the same yield was obtained as when the nitrogen was spread over three applications. This had the further advantage that the solids in the juice were increased, which is an important quality characteristic.

It was found that, under the conditions of the trial, the optimal level of nitrogen application was about 680 g of nitrogen per tree a year.

Diseases and pests

In an experiment during 1970 where tetracycline HC1 was injected into the trunks of Valencias, the percentage of greening was reduced from 60 to 15. Although no further treatment was applied, the percentage of greening remained low for two years.

An experiment was conducted to determine the best time to apply tetracycline HC1. Valencias near White River were treated with the antibiotic during July, September and November. The reduction in the percentage of greening in comparison with the previous year was as follows:

July treatment — 3 per cent, September treatment — 10 per cent and November treatment — 1 per cent. It, therefore, appears that the best time for treatment is spring.

Various tetracyclines were tested on trees suffering from greening. Tetracycline HC1 again gave the best results. Oxytetracycline HC1 had a slight effect on greening, and chlortetracycline HC1 had no effect.

In experiments using heat treatment carried out on citrus trees suffering from greening four years ago, the percentage of greening in the trees was reduced from 80 per cent to 0 per cent. Although no further treatment was applied, the percentage of greening remained low.



The difference in tree volume between these two trees is obvious: the tree on the left had a plastic soil surface cover and weedicides were used when necessary while the grass around the tree on the right was only cut regularly. Drip irrigation was used in both cases.

An experiment to establish the percentage of greening of four trees per orchard in 10 orchards near Nelspruit and White River has been in progress since 1965. The drop in the percentage of greening during the past year was 4 per cent. The total decrease from 1965 to 1972 is 24 per cent.

Cold storage of export fruit

Research on the cold storage of Swaziland grapefruit and oranges to control fruit flies has been completed. Infested grapefruit and oranges were stored at $-0,5^{\circ}\text{C}$ for 12 days and the mortality of the fruit fly larvae was then determined. A hundred per cent mortality was obtained in both groups.

The results of the trials were submitted to the plant quarantine section of the Japanese Ministry of Agriculture. The results led to the acceptance of Swaziland grapefruit and oranges for export to Japan.

Control of citrus pests

Further progress with integrated control was made in the Rustenburg area where 84 per cent of the citrus trees are now under the integrated control programme which was commenced by the Citrus and Subtropical Fruit Research Institute. The introduced red scale parasite *Comperiella bifasciata* appears to be permanently established and has started to spread to other orchards. Although no longer spectacular in orchards once the scale population has decreased, it may prove to be more efficient than the indigenous *Habrolepis rouxi* Comp. and may result in a slightly lower rate of increase of red scale.

Encouraging progress has been made in the Citrusdal area where both *C. bifasciata* and *Chilocorus distigma* appear to be established. *C. cacti*, which at first gave spectacular results, was disappointing this season.

The transition to integrated control remains a difficult problem in certain orchards.

Citrus psylla — Weather conditions, particularly during spring, were very favourable to the citrus psylla, with the result that the level of infestation was generally high. A early warning to citrus growers through the medium of the agricultural press and the radio enabled growers to control the pest in good time.

Citrus mite — During the past decade there has been a gradual decrease in the use of the insecticide parathion on citrus. This has meant that the citrus red mite *Panonychus citri* has caused less trouble than during previous years, because the use of parathion promotes red mite infestations.

On the other hand citrus bud mite *Aceria sheldoni* is becoming an important problem where commercial sprays are reduced in order to promote the biological control of pests. A long-term trial during the past season demonstrated that it is possible to establish practical control of this mite pest by means of two sprayings with Acarol.

The same programme also provides economic control of rust mite *P. oleivora* and *Brevipalpus* sp.

False codling moth — In a study aimed at establishing the seasonal incidence of false codling moth in citrus orchards, sticky traps were used with unmated female moths. The number of male moths caught is an indication of moth activity in orchards. It was found that large catches coincide with rainy periods. Conversely, the fewest moths were observed during hot, dry periods.

Egg counts carried out on fruit also serve as an indicator of moth activity and are used to determine parasitism. It appears that the spraying programme generally followed in commercial orchards in the Lowveld is sufficient to suppress false codling moth infestations to a large extent during the early season. On the other hand it was found that an unsprayed orchard has as much as 7 per cent infested fruit by the end of November. Oviposition takes place from early in the season onwards and may be correlated with moth catches in traps.

Parasitism (*Trichogramma* sp.) of eggs on the fruit in unsprayed orchards was recorded for the first time at the beginning of January.

A phytosanitary treatment developed to protect fruit against all stages of the false codling moth was approved in principle by the Department of Agriculture of the United States of America.

Harvesting and handling

The provision of pre-cooling space at harbours is very expensive. Experiments were undertaken to evaluate techniques to ensure a high rate of flow of the fruit through the pre-cooling sheds.

Various orange cultivars were pre-cooled by means of air with a supply temperature of $-0,5^{\circ}\text{C}$. It was found that pre-cooling to this temperature had no adverse effect on the following cultivars: Washington Navel, Valencia Late, Protea and Tomango. Disa oranges showed a tendency to develop rind pitting as a result of cold damage.

The industry has already applied this pre-cooling technique successfully. Further research is being carried out to determine whether there are seasonal differences in the development of cold damage.

Low temperature sterilisation of lemons and grapefruit – The development of export markets, where low temperature sterilisation of fruit against the fruit fly is necessary, is creating considerable problems in the case of lemons and grapefruit that are exported at 11,1°C. It was found during the 1971 season that a period of 12 days at -0,5°C causes rind pitting as a result of cold damage. The light cold damage varied from as little as 0,3 per cent on fruit from one area to 9,0 per cent on fruit from another area. The incidence of serious cold damage was low, however, being no more than 1,5 per cent where the fruit was kept at -0,5°C for 12 days.

A high percentage of rind pitting occurred in fruit in one export consignment. Colour slides and

descriptions of the damage indicated that diphenyl scorch, and not cold damage, was the cause. The percentage of diphenyl scorch that occurred in lemons during the storage trials was far higher than that of cold damage. However, this should no longer be a problem since the 1971 season was the last season when the use of diphenyl wrappers for export lemons was permitted.

The percentage of rind pitting (real cold damage) on grapefruit from two different areas was low where the fruit was stored at -0,5°C for no longer than 12 days. However, the percentage of cold damage on fruit harvested fairly late in the season was high (14 per cent) after a storage period of 24 days at -0,5°C.

SUBTROPICAL FRUIT

The following number of trees was available in registered nurseries:

Avocados	161 200
Mangoes	82 000
Guavas	20 800
Litchis	28 800
Olives	25 500

Most of the avocado, mango, guava and litchi trees are found in Transvaal nurseries.

Avocados

The production of avocados is still showing a tendency to rise and was 8 000 metric tons last year, with a value of R1 676 000. According to a survey there are already more than 263 000 avocado trees planted, nearly two-thirds of which are still less than five years old.

In registered nurseries there were 161 200 young avocado trees available. Together with mango, guava and litchi trees most of them were available in Transvaal nurseries, viz 560 000 out of a total of 565 000.

Remaining an important problem is the rapid deterioration of avocado trees owing to two primary causes, viz root rot, caused by the fungus *Phytophthora cinnamomi* and sun-spot virus. The propagation of avocado trees is closely connected with the problem of deterioration.

Research is being done on the propagation of avocados by means of cuttings. Only with the etiolation method has any success been achieved to date. It was determined that an abnormal graft union occurs in the case of the avocado, and that this phenomenon may be linked to infection by sun-spot virus.



The control of thrips with Temik in citrus seed beds: Temik was used on the tree on the left but not on the tree on the right

Knowledge of the storage of avocados has advanced to the stage where the fruit may be exported with a reasonable measure of success by making use of the right storage temperature and packaging material. However, many problems are still being experienced with ripe rot.

Significant advances in the area of packaging and storage are primarily dependent on effective spoilage control, which will, it seems, be achieved only by means of orchard spraying.

Diseases and pests

A large replant trial has been laid out in a commercial orchard using general soil sterilants such as methyl bromide and chloropicrin and also fungicides specific for *Phytophthora* control. In addition deep ploughing is compared with conventional ploughing to determine the effect of improved drainage on disease incidence. Preliminary results indicate that Telone, Dexon and Vapam are the best treatments, whereas the control replants are already showing signs of decline.

In two post-plant trials in a severely diseased avocado orchard, chemicals and mulch treatments are being compared for effectiveness in combating root-rot. It has been found that a lucerne meal mulch is highly phytotoxic under conditions of high rainfall, particularly when combined with a plastic mulch.

During the year a pot trial to study the effects of various treatments on the number of Dexon applications needed to control root rot was laid down. It was found that when Dexon was used in conjunction with a single application of either Brassicol, difolatan or plantvax, the length of time between Dexon applications could be extended from four to six weeks.

It was also found that the use of lucerne meal and sawdust as mulches had a marked effect on root rot development, the greatest reduction in root rot development occurring under the lucerne meal mulch, with the sawdust mulch not giving quite such good control. No phytotoxicity was observed in this trial.

As a result of the heavy rains during 1971/72 anthracnose disease *Colletotrichum gloeosporioides*, was particularly severe in Fuerté avocados, and an experiment was conducted at Nelspruit in the course of which five applications of different fungicides were compared. The plots treated with fungicides difolatan, mancozeb, Calizim, copper oxychloride and benomyl all differed significantly from the untreated control plot while not differing from one other. A timing trial will be conducted next season in order to try to reduce the number of applications.

In the Tzaneen area export losses as high as 80 per cent have been reported in a few isolated instances in which phomopsis spot recurred. Following the heavy rains during the 1971/72 season, however, this disease



Symptoms of graft incompatibility in the avocado: the upper stock shows smudges in the wood while the rootstock appears healthy

has spread alarmingly throughout the Northern Transvaal avocado plantings. It is estimated that this disease has resulted in an overall loss in export avocado fruit of 10 per cent, equivalent to 20 000 trays out of a total of 200 000.

Treatment and fertilisation

The results of analyses of avocado leaves submitted by producers show that reduced nitrogen applications last season, together with the high rainfall, have led to a decrease in the nitrogen content of the leaves. Most of the orchards, however, still show a nitrogen content that is too high.

In spite of a very slight decrease in potassium applications and, in most cases high potassium values for the soil, the potassium content of the leaves has dropped excessively this season. This decrease can only be ascribed to the withdrawal of potassium from the leaves by the large crops this year and/or by leaching of potassium from the leaves by the abundant rain this season. It is also clear from the results of the analysis that producers will have no problems with magnesium and copper. The boron content of the leaves tends to be low. This last problem, however, has not yet assumed serious proportions. From the preliminary results of avocado leaf analyses it is clear that the producer will benefit greatly by this service.

Bananas

Good rains during the past year resulted in a further increase in banana plantings throughout the Transvaal Region, particularly in the Malelane Lomati area. The value of the crop, at R5 000 000, was the same as that of the previous year. Plantations in the surroundings of Tzaneen, extending over about 1 500 ha, yield 12 per cent of the total production of the Republic and Mozambique.

The drought in 1970 changed the usual production pattern. Instead of the normally high production from November to February last year this peak occurred two months earlier, followed by an unprecedented low crop during what is usually the optimum production period.

Promising Cavendish selections are still being collected for evaluation in order to find a selection that will be superior in all respects to the Dwarf Cavendish. Among the selections collected so far seven have been found to show promise and these are now being tested on an extensive scale.

Research in connection with crop-timing to obtain a winter crop when prices are high is continuing. Results so far show promise. In another crop-timing experiment various combinations of planting time are being tested. Results so far show that very young suckers

(spearpoints) planted in November and December produce a good out-of-season crop 18 to 20 months later.

Phenological studies have been in progress for several years and so far it has been found that the active period of growth of the plant is from December to February only.

The development period of the bunch from flowering to harvesting varies greatly, depending upon the time of year the flower emerges. This development period varies between 110 and 213 days.

The first crop results of the extensive banana fertilising project at Burgershall shows no great response to treatment. Nitrogen applications resulted in more hands per bunch, and more but smaller fingers per hand. The investigation of the effectiveness of leaf analyses to ascertain the feeding status of bananas in practice is progressing well.

After the discovery of the burrowing *Radopholus similis* on bananas in December 1969, the subsequent eelworm survey in all the banana-producing areas of South Africa showed that this root parasite is widespread along the Natal South Coast. In the Transvaal Lowveld only nine farms showed signs of infestation.

On seven of the farms in the Transvaal where the burrowing eelworm was found, the infected orchards have already been treated.

So far, 90 different plants and agricultural crops have been tested on the experimental farm at Anerley for their susceptibility to the biotype of *Radopholus similis* which attacks bananas in Natal. The results indicate that the roots of brinjals, coffee, groundnuts, maize, potatoes, plantain bananas, sorghum, soya bean, sugar-cane and tomatoes may be invaded and damaged by the burrowing eelworm.

Studies on the vertical distribution of this eelworm in the soil have shown that in infested plantations it may be found to a depth of one metre.

A committee formed in the Durban-Pinetown area will, with the aid of the Indian Council, advise Indian banana farmers in that area on the seriousness of this eelworm pest.

In June 1972 *Radopholus similis* was recorded for the first time from two small Dwarf Cavendish banana plantings in Zululand.

The dehydration of ripe, whole bananas is now being investigated. It has already been found that

fumigation with sulphur dioxide before dehydration greatly improves the appearance and keeping quality of the dehydrated product.

The dry ratio, that is the mass of fresh fruit needed to produce one unit of the dry product, was 5,8 of average.

Mangoes

The annual production of mangoes in South Africa is increasing, and is already almost 10 000 metric tons per annum, to the value of R1 120 000, an increase of R300 000 compared with the previous year.

Many new plantings have been established and others are being planned so that a further increase in production is expected over the next few years.

According to a survey there are at present almost 736 000 trees planted or due to be planted. Of these, almost 200 000 are bearing, more than 250 000 are still too young to bear, and the planting of approximately 282 000 is planned.

The rate of planting of fibreless mangoes in the valley of the Njelele River is dropping, but the present rate is being maintained in the Levubu valley.

In registered nurseries there were 82 000 trees available.

The mango pruning trial on old, poorly producing trees during the past year again showed that mango trees produce very good yields if they are exposed to enough light and air movement. In the treatment where every alternative tree was cut back severely, 109 kg more fruit per tree was harvested than in the control trees that were crowded together.

The first seedling trees planted for selection are growing well and they flowered during the past year. Two of them have already borne fruit that has much promise according to preliminary observations. 900 trees have already been planted. Although the cultivation of mangoes is being much expanded by new plantings, it would appear that the quantities marketed can still be greatly increased by increasing the productivity of existing trees. Flower formation, pollination and early



Peeled whole bananas are dehydrated in a small-scale dehydrating apparatus

falling of the fruit play an important role. During the past season, however, it appeared that losses should be ascribed to pathological problems such as bacterial black spot and anthracnose, which are the biggest limiting factors.

The handling of fruit from harvest time to marketing leaves much to be desired. This is one of the most important reasons for the low percentage of marketable fruit obtained per tree, viz 6 trays per tree instead of a potential 20 to 30 trays per tree.

The primary damage is caused by bacteria of the genus *Erwinia* which leads to bacterial black spot. It has further been found that this disease causes a darkening of the liquid in the resin ducts. The way in which it progresses is at present being investigated.

The mango weevil is still one of the most important mango pests, particularly on cultivars that ripen late in the season. Irradiation trials are being carried out in co-operation with the Nuclear Research Centre of the Atomic Energy Board at Pelindaba. The results show that the irradiation of the affected fruit has a definite influence on the activity of the beetle in the fruit.

In respect of the soft brown rotting problem remarkable results were achieved. By treating the fruit with a warm fungicide suspension instead of with the usual warm water, this rotting was completely eliminated.

Research into bacterial black spot on mangoes, which assumed serious proportions, was undertaken. This disease was investigated about 1915 and the pathogen concerned was isolated and described. At present everything indicates that the wrong pathogen was isolated at the time, and that this misled later researchers. Now the chance of success is much better, and research on the control of this disease and epidemiology can be undertaken.

This finding is a breakthrough of international importance.

Pawpaws

The total production of pawpaws is more or less constant at about 17 000 metric tons, to the value of R1 178 000. Fruit to the value of about R10 000 is used for canning.

Pucciniopsis spot or black speckle

A new spotting disease on fruits and leaves of papayas in South Africa referred to as *Pucciniopsis* spot (causal organism *Pucciniopsis caricae*) was described as being a problem in the coastal and inland areas of Natal



Mangoes which are unmarketable because insect and pest control was not applied efficiently



Pucciniopsis blemishes or black spot, a new problem in pawpaws

in 1971. The disease has since spread to most of the papaya-producing areas of the Transvaal following the heavy rains during the 1971/72 season.

The very rapid spread has been viewed with alarm by the growers who are now faced with the prospect of possibly having to spray their trees in order to be able to market their fruit. Besides making the fruits appear unsightly these spots also serve as avenues for secondary infection by the anthracnose and *Rhizopus* fruit-rotting organisms. Fungicide screening experiments will be conducted.

Post-harvest rot

With the appearance of *Pucciniopsis* spot on the fruits and with the very wet conditions during the previous season, both of which have greatly enhanced the post-harvest rot development on papayas, there has been an increased need for application of post-harvest treatments to papayas for both local and overseas markets.

The results from several experiments conducted at various periods during 1970–1972 have indicated that from February to October anthracnose and *Ascochyta* rots were the most important. These could be controlled fairly satisfactorily with a hot water dip treatment.

However, from November to January another rot referred to as *Rhizopus* rot appears on the stored fruits and cannot be controlled with the hot water dip treatments. Effective control of *Rhizopus* rot was obtained with two systemic fungicides, one of which proved to be phytotoxic at the concentrations used.

A pawpaw disease, hitherto unknown in the Republic, was observed in 1971 at Ukulinga, the experimental research farm near Pietermaritzburg. Subsequently the disease was found to be present in the coastal region from Northern Zululand to Port St. Johns. Small black spots appear on the lower surface of the leaves and spots may also develop on the fruit. Yellowing of the leaves and defoliation usually result.

Spotted fruit loses its attractiveness and market quality is lowered. Promising results have been obtained at Ukulinga by spraying with fungicides.

The disease is caused by the fungus *Asperisporium caricae* (*Pucciniopsis caricae*) (Black Speckle).

Pineapples

The estimated tonnage of pineapples received by the five pineapple factories in the Eastern Cape Region during the year under review was 136 500 tons, while about 24 000 tons were received by the two factories in

Natal. Production was, therefore, appreciably higher than in the previous year, and this is ascribed to various factors.

Large pineapple producers expanded their production, while a number of smaller farmers stopped producing pineapples during the past year.

The present fairly general use of synthetic hormones to regulate crops has also had the important effect of increasing yields.

Exports of fresh pineapples, mainly to the United Kingdom, have increased appreciably, viz from 334 693 trays in 1970/71 to 500 246 in the year under review.

An important new development is that the biggest exporter of fresh fruit is sending trial shipments by air. The first shipment of 2 400 trays in a single flight was sent to London in June. The shipment was very successful. Four days after it was loaded it arrived on the London market. The quality was still excellent and good prices were obtained.

The increase in the phenomenon known as leathery pocket is disturbing. A survey revealed that the percentage of fruit with leathery pocket was more than 40 during the period January to March and that the percentage of infected fruit was 60 during February and March. Infected fruit is not suitable for export.

Internal decay, translucency and bruising

During the year under review large losses were suffered on account of internal decay, translucency and bruising of fresh export fruit. All in all, 13 484 trays (2,81 per cent of the shipments) from farmers in the East London area were rejected on account of internal damage from sunburn. As a result of translucency 8 293 trays (1,46 per cent) were rejected at the same harbour, and in Port Elizabeth 7 320 trays (1,29 per cent) were rejected on account of bruising.

It was found that the woolly aphid which causes woolly aphid wilt in pineapples, could be controlled to a large extent by using clean planting material. Because the woolly aphids hide in the axils of the lower leaves of planting material, the insects are easily destroyed if the lower leaves are removed and the planting material is spread out upside down in a sunny spot.

Good control of the woolly aphid is achieved by controlling ants on the fields by destroying ant-hills before planting time and HHDN (Aldrin, Protekta D, Aidinel).



History was made at the Ben Schoeman Airport, East London, in 1972 when the first big consignment of fresh pineapples (24 tons) was loaded for dispatch to London

Artificial flower induction

Experimental results have shown that the use of synthetic hormones to achieve flower induction is essential for the successful and economic production of pineapples. Not only are yields considerably increased because all the plants or shoots are forced to bear, but the crop is also regulated. This is essential if the most efficient use is to be made of labour, which can obviate damage to fruit as a result of cold and sunburn.

Trials are being carried out to determine the efficiency of ethephon and acetylene gas for flower induction.

Fertilising

In a trial at the East London Research Station it was found that the plants respond much better to the spraying of potassium sulphate on the leaves than to applications in the soil. Quantities of 550 and 1 100 kg per ha were administered in 15 monthly sprayings at concentrations of 1,66 and 3,32 per cent respectively.

From field trials emerged the important result that the best response to urea spraying could be achieved when the urea was applied during the six months preceding flower differentiation. Plants that had a dark green leaf colour when flower differentiation started produced the highest yields. No difference in yields was achieved between plants sprayed only in summer, only in winter or throughout the year.

As a result of continued selection there is at present a total of 5 000 Smooth Cayenne plants available at the Bathurst Research Station, with improved plant and fruit characteristics. The East London Research Station at present has 2 000 improved plants available. An important characteristic of the selected material is that the internal colour, as proved by canning trials, is better than that of unselected material.

Arrangements are being made for the distribution of this improved material to farmers.

Granadillas

There has been a further expansion of the granadilla industry, a trend that appears to be continuing. Interest in growing this crop has spread to the frost-free areas of Natal, the Eastern and the Western Cape.

One of the most important factors for the expansion and possible consolidation of this industry is the establishment of new processing plants following on an increased local and overseas demand for the processed juice.

During the past few seasons a closer study has been made of the yellow, or golden, granadilla and it has been found that this type grows and bears well in the hot, low-lying areas of the country. Preliminary results at the Messina Experimental Farm and at the Makatini



Such a magnificent uniform pineapple crop is obtained by applying artificial flower induction

Research Station in Northern Zululand show that the yellow granadilla is doing extremely well. In the past there has been a considerable resistance by processors to the juice of this yellow type, but this attitude appears to be changing.

Seed of the purple granadilla crossed with the yellow granadilla was imported from Australia and the seedlings have been evaluated during the past season. Of the 600 odd hybrids, eleven are showing promise and these are being multiplied to enable a more rigorous evaluation. Evaluation of hybrids and new species will continue until a suitable one is found which meets the requirements of both the processor and the fresh fruit market.

Guavas

There is renewed interest in the production of guavas, particularly owing to the increased market for processed guava products such as guava juice. The present production is about 12 000 metric tons a year, 8 000 metric tons of which is processed.

In registered nurseries there were 20 800 guava trees available.

The standard cultivars do not meet all the quality requirements for the marketing of fruit for the fresh market and for processing to juice or canning. A selection programme is being carried out to improve the present cultivar status. About 35 fruit samples were

analysed during the past year and 6 selections were made for further tests. The most important characteristics of the selected fruit are the firmness of the fruit flesh, without internal pockets and with few pips.

Litchis

The litchi industry is producing fruit to the value of about R300 000 per annum. There is a good export market for litchis, and about 100 metric tons of fruit is exported every year. The most important export market is the U.K. but the continent of Europe offers good possibilities for the future.

There are at present about 3 500 trees planted in the Levubu valley. In registered nurseries there were 28 500 trees available.

In South Africa only one litchi cultivar is grown commercially, viz H.L.H. Mauritius. This cultivar is a selection made from the trees originally imported from Mauritius. Other cultivars already tested are of poorer quality.

During the year under review it was discovered that other seedling types occur in the Transvaal and Natal with very good fruit characteristics and fruit of a high quality. A survey will, therefore, have to be made of all the unknown types.

During the investigation of the detrimental effects caused by two nematode species on litchi trees it was

discovered that the root-knot nematode *Meloidogyne javanica* will also attack litchi roots. Laboratory inoculations further confirmed this observation. A mite species was also found to damage litchi roots.

Coffee

As a result of unfavourable climatic conditions, particularly drought, last year's coffee crop was smaller than in previous years. The crop was 152 metric tons, worth R101 300. Coffee imports amount to about 12 000 tons a year.

In the vicinity of Tzaneen there are about 70 000 coffee trees in bearing.

An important aspect of coffee research is still to determine which cultivars are best acclimatised in South Africa and will produce the best yield of high quality coffee. The cultivar SL14 showed a high measure of resistance to coffee rust. The best production was achieved with the cultivars SL14, SL34, SL28 and Kenya Blue Mountain.

Coffee leaf rust

Timing and screening experiments using various organic, copper and systemic fungicides were continued at sites in Natal and the Transvaal. At one site, at Nelspruit, the treatments were applied to the same plots over two consecutive years so that a comparison could be made on yields.

From the results obtained thus far (see below) it is obvious that the cumulative effects of all the spray treatments over the two seasons have resulted in a marked increase in yield compared with the untreated controls:

	Total yield (kg) over 4 weeks' harvest
1. Control (unsprayed)	0,02
2. Copper oxychloride	13,84
3. Plantvax	12,73
4. Difolatan	18,75
5. Benlate + CuOC1 ₂	11,45
6. Hoe 6052	3,71

Coffee snout beetle (*Ellimenistes laeicollis*)

Regular weekly field counts of *E. laeicollis* made on young coffee trees at a private estate indicate that the adult snout beetle may be found in coffee plantations from September to June, with the greatest numbers occurring from November to March.

The seasonal abundance of the snout beetle appears to be related to temperature and to a lesser extent rainfall.

A comparison of the beetle population densities in 1971 and 1972 shows that the number of beetles recorded from coffee trees in 1972 was markedly lower than that recorded in 1971. While this difference may be due in part to the seasonal variations of temperature and rainfall it is felt that the practice of clean cultivation now being followed by this estate is responsible for the lower number of beetles in 1972.

The preliminary evaluation of several insecticides for the control of *E. laeicollis* on mature coffee indicated that only D.D.T. and azinphos-methyl (Gusathion) provided commercially acceptable control. The use of a non-phytotoxic sticky barrier, Formex, also showed promise.

Tea

The present production of tea in the Republic is about 500 000 kg, worth R550 000. The tea plantings are still young, and an increasing production may be expected. At present about 21 million kg of tea is imported annually.

About 700 ha in the vicinity of Tzaneen has already been planted to tea.

For the young tea industry in South Africa it is a requirement that well-adapted clones must be found that will produce a high tea yield of good quality.

During the year under review a selection programme was started in which 80 000 tea shrubs were examined. 45 of these were selected and will be subjected to further strict yield and quality tests.

STRAWBERRIES

During the past season six nurserymen in the Transvaal participated in the strawberry selecting scheme. Three cultivars were offered for certification, and the following quantities were finally certified:

796 050 Festival plants
93 200 Earlibelle plants
32 450 Parfaite plants

A total of 42 000 plants was rejected owing to the occurrence of eelworm.

Seven nurserymen in the Western Cape took part in the selection scheme during the past season. 83 600 Plants were offered for certification, 5 500 of which were rejected on account of eelworm infestation.

It was decided to allow only 2 nurserymen in the Western Cape and 3 in the Transvaal to take part in the scheme from the next season.

Breeding

To determine the adaptability of promising strawberry selections in the Summer Rainfall Region, they were planted co-operatively on four strawberry farms. Two of these farms were situated in frost-free regions, while one was on the Highveld and another in the Middleveld.

Preliminary indications in the frost-free area are that two selections (68/41 and 69/140) start bearing as early as 9 May. This is about three weeks earlier than the earliest cultivar. Selection 69/140 also produced good winter yields last year. During the past season the mother plants (second-year plants), as well as the new plantings planted at Roodeplaat, started bearing earlier than 68/41.

Selection 69/457 was the most promising during the past season. It not only produced the highest yield of 30 tons per hectare, but also produced the largest fruits, weighing 13,3 g each on average. In addition the plants are also very vigorous and the fruit quality is good. This selection is being co-operatively tested on strawberry farms.

At the Fruit and Fruit Technology Research Institute 6 500 seedlings were obtained from controlled crosses this year. Of the roughly 5 000 seedlings from the previous year, 38 were selected as promising and are now being tested further.

Diseases

The elimination of viruses carried by plant lice in promising local as well as overseas strawberry cultivars is continuing. Material of Parfaite, Earlibelle and Robyn has already been handed over for pomological evaluation. Pomological evaluation of heat-treated material from selections of Tioga, Klaradyn, Karmyn and Festival will be undertaken during the 1973/74 season.

Preliminary studies of the effect of viruses on production have shown that commercial strawberry production from initially virus-free Festival is eventually less than 50 per cent of the potential yield.

The fungus that causes wilt disease in strawberries has now been positively identified as *Verticillium dahliae*. Trials have shown that this fungus can reduce the stand by 50 per cent and the crop by almost 90 per cent. The disease is favoured by high soil temperatures, continuous wet conditions and damage to the root system.

It can be prevented by first dipping the roots of plant material in a solution of fungicide such as difolatan, benomyl-dinocap or thiabendazole. After planting, only disinfection of the soil with benomyl or thiabendazole will give some control.

Planting time

To date strawberries in the Winter Rainfall Region have usually been planted in June-July, with varying success. From the preliminary results of a trial at Bien Donn  in which three strawberry cultivars were used, it appears that yields can be much increased by earlier planting.

For Parfaite May was the best planting time, while Earlibelle and Festival must be planted as early as April. The crop of the last-mentioned two cultivars planted in April was double that of the plantings made in June and four times that of August plantings.

FLOWERS AND ORNAMENTAL SHRUBS

A total of 719 026 kg of cut flowers was exported this season under cover of 1 873 health certificates. This is 104 259 kg more than the previous season's exports. Most of these flowers are exported through the Jan Smuts Airport, but the increase last season was mainly due to a much heavier volume of such flowers exported through the D.F. Malan Airport at Cape Town.

Most of the export flowers were carnations, gladioli, roses and proteas, most of them, approximately 58 per cent, being exported to Germany, the United Kingdom, Italy and the Netherlands.

The roses and carnations offered for inspection during the past season were generally clean, with a few rejections on account of carnation worm and bollworms. Owing to stricter import control in the Netherlands and the U.K. quite a few gladioli were rejected on account of gladiolus rust.

All in all, 56,4 million ornamental shrubs, roses, glass-house plants, etc., were available in registered nurseries. They included:

- 15 200 000 forest trees
- 4 100 000 ornamental trees
- 2 700 000 roses
- 5 300 000 glass-house plants
- 1 700 000 palms
- 1 800 000 hedge plants
- 7 000 000 shrubs

This season 22,2 million of these plants and cuttings were exported, as against 16,5 million last season. This is an increase of 5,7 million. 823 health

certificates were issued for the exportation of these plants. Of the exports about 85 per cent were *Leucospermum* and carnation cuttings and most of the plants – 15,3 million – were exported from Jan Smuts Airport.

A total of 2,8 million plants and cuttings were imported during the past season under cover of 592 permits. These imports consisted mainly of unrooted cuttings.

Carnations

A study of the carnation-worm *Epichoristodes acerbella*, which is a major problem in flowers exported to Europe, revealed that low temperatures of 1,5°C had to be maintained for at least 20 days to get an effective sterilisation of the plant material if they were infested with eggs of the carnation worm. The pupae were even more resistant to low temperatures.

Because of the effect of these relatively long low temperature treatments on the plant material itself and the relatively low mortality of the carnation worm due to this treatment, cold treatments alone cannot be used on flowers and cuttings for export as a sterilant. Treatment with certain insecticides were, however, very effective. Amongst these, methomyl was the most effective.

Roses

Die-back due to *Verticillium dahliae* is still a major problem in rose cultivation in South Africa. However, it became clear that certain other factors except *Verticillium* may also contribute to this die-back.

A fungus which causes a leaf and stem necrosis on rose rootstock was definitely identified as *Cercospora rosicola*. It was found, however, that certain differences occurred between the isolates collected from roses at the Horticultural Research Institute and those described in the literature. This problem will have to be investigated further.

During the winter of 1972 the following virus-indexed material was distributed to nurserymen or released for experimental purposes:

- 514 hybrid tea trees of 49 cultivars
- 290 floribunda trees of 41 cultivars
- 27 380 commercial rootstock cuttings
- 29 104 cuttings of 16 other rootstock types

There were also a few requests for *Rosa damascena*.

Some of this material was sent to France, the Netherlands and New Zealand for trials by co-workers visited during study tours and some to Rhodesia.

An independent panel of nurserymen and rosarians of the Rose Group of the South African Nurserymen's Association now judge all new rose introductions received and budded at the Horticultural Research Institute. On their recommendation only 23 new cultivars were added this year for virus-indexing and propagation.

Proteas

The tendency of the foliage leaves of irradiated protea flowers to turn black more quickly can be effectively suppressed by placing the leaves in a solution of preservative after irradiation – a solution of maleid hydrazide (0,025%), aluminium sulphate (0,001%), citric acid (0,01%), hydrazine sulphate (0,001%) and sucrose (3,5%). This preservative also leads to a dramatic improvement in the keeping quality of the flowers.

With the irradiation doses normally needed to control insects by sexual sterilisation, no detrimental effects have to date been noticed on the flowers.

Last year 17 leaf spot diseases in the genera *Protea*, *Leucospermum* and *Leucadendron* were described.

Several of these diseases had not previously been described or had their causal organisms identified. The identification of these organisms is now in progress.

Chrysanthemums

For the first time infection of chrysanthemums with the fungus *Verticillium dahliae* was identified in South Africa. Symptoms were first observed when the plants came into flower. The lower leaves start to turn yellow and then brown. At the same time the leaves wilt.

Lachenalias

The evaluation of *Lachenalia* breeding lines has been continued and those that are promising will receive further tests for their commercial possibilities. Of the three breeding lines at present under test at commercial growers one provides the best results and will be released as a new cultivar in the near future.

Poinsettias

During the past ten years the production of dwarf poinsettias as pot plants has increased tremendously in America and in Europe so that the poinsettia has become the world's fourth most important commercial

flower. As a pot plant the poinsettia has the advantage of long keeping qualities. Good specimens may remain attractive for up to three months. Trials carried out at the Horticultural Research Institute at Roodeplaat have shown that given suitable conditions all the year round production of these plants is possible in South Africa.

An apparatus by means of which potted poinsettias could be watered and shortday treatment be applied automatically was evolved and tested and found to give satisfactory results.

Lilies

Many of the most attractive lily cultivars tend to grow too tall for effective use as pot plants. However, with the availability of growth depressing chemicals for height control the possibility existed of developing some of the lily cultivars as pot plants.

In preliminary tests with six cultivars using Cycocel for reducing stem height, three were successfully dwarfed and made excellent pot plants. The effects of treatment varied considerably with different cultivars. The dwarfing treatment resulted in a shortening of the internodes between the leaves, but did not influence the size of either the leaves or the flowers.

Pelargoniums

Preliminary experiments on the effect of a night break in influencing the flowering time of regal pelargoniums have been carried out. Plants were given three hours lighting each night from 11 p.m. to 2 a.m. starting on April 10.

By June 21 the cultivars Salina, Strawberry Sundae and Autumn Haze lit with a 100 watt incandescent lamp were in flower and under fluorescent light the cultivar Salina. None of the control plants under normal day-length were in flower at this time.

Medicinal plants

Interest in the possibilities of cultivating certain plants of value to the pharmaceutical industry in South Africa has continued to grow. There is an increasing demand by local firms for raw materials for drug extraction and as the world requirements for these products are also far from saturated the chances are also good for the development of an export market.

Among the plants at present receiving attention are *Silybum marianum*, *Digitalis lanata* and several species of *Datura* and *Vinca*.

Trials so far carried out have been aimed at determining basic cultivation requirements such as the best time of planting, optimal spacing and methods of

weed control and harvesting. For example with *Silybum marianum* it was found that the highest yields were obtained from May plantings.

However, seed crops with a satisfactory alkaloid content have not yet been obtained and further investigations will be aimed at determining whether this deficiency is due to the cultivar or to climatic or nutritional factors.

In the case of *Digitalis lanata* the best sowing time is in early spring. The seed can be sown in beds similar to tobacco seed beds and treated in much the same manner. The leaves are ready for harvesting about 150 days after planting out. Irrigation is essential and a yield of between 2 000 to 3 000 kg per hectare in the summer rainfall areas appears quite feasible.

Ornamental plants

Preliminary work on the selection of ornamental shrubs and trees with the view to the provision of planting material of known and proved performance has been started.

Species receiving attention include American sweetgum *Liquidambar styraciflua*, weeping bottlebrush *Callistemon viminalis*, purple magnolia *Magnolia soulangeana*, white stinkwood *Celtis africana*, firethorn *Pyracantha angustifolia*, churchyard cypress *Cupressus sempervirens* var. *stricta*, Pride of de Kaap *Bauhinia galpinii*, London plane *Platanus acerifolia*, pin oak *Quercus palustris*, jacaranda *Jacaranda mimosaeifolia* and pearl acacia *Acacia podabyriaifolia*.

Many of the species are not easy to propagate and it has become clear that the evolution of successful methods for their vegetative propagation is essential and will require intensive investigation in future work.

NUTS

Various registered nurseries made 351 800 trees available during the past season. This was an increase of 128 500 over the previous season.

Most of the trees, viz 305 000, were raised in Transvaal nurseries, followed by Natal with 40 300 trees.

The planting of pecan and macadamia nuts is still receiving much attention in the Levubu district. At present there are about 20 000 pecan and macadamia trees planted in the area. The rate of planting will probably still increase since many farmers have recently started nurseries.



Pecan nut borer moths

Pecan nuts

An insect borer that has in the past occurred sporadically on pecan nut trees assumed pest proportions in 1971 in certain orchards in the vicinity of Nelspruit.

Larvae of this moth *Eulophonotus myrmeleon* are responsible for the damage since they bore into the branches and the main stem of the trees. The first signs of infection are reddish brown crumbly excretions around the base of the trunk.

The adult female moth is black with a wingspan of about 60 mm. The males differ from the females: they are slightly smaller and have transparent wings with a wingspan of about 40 mm.

Eggs of the moth are laid on the trunk and hatch after 12 days. Shortly afterwards, the young larvae start boring into the trunk. The larvae stay in the trunk for about 11 months and reach their maximum size, about 40 mm, during spring and early summer. They pupate in the tunnels, and after 6 weeks the adult moths hatch.

To date no chemical preparations have been registered for the control of this pest. The only method of control, particularly in young trees, is to kill the larvae in the tunnels with a soft wire.

In the study of this pest it was observed that a yellow wasp, about the size of a honey bee, hatches out of the pupae of the borers. This wasp was identified as a *Genaemirum* sp. (of the Ichneumonidae family). However, it is not yet known whether this parasite is a larval or pupal parasite.

No other host plant of the pecan nut trunk borer has to date been found in South Africa. However, it is known that this moth is a pest on cocoa trees in Zaire.

Macadamia nuts

With the object of selecting locally adapted cultivars of macadamia nuts several thousand seedling macadamia trees growing in various parts of Natal have been screened for desirable characteristics, such as good tree shape, high yielding ability, round nuts about 25

mm in diameter, even shell thickness, about 40 per cent kernel, good colour, flavour and oil content of kernels, etc.

Some 50 preliminary selections have already been made. Vegetatively propagated trees of these selections have been established at the Ukulinga Research Station near Pietermaritzburg for further evaluation.

The first results of the fertiliser project on macadamia nuts show a highly significant increase in production after applications of nitrogen.

An investigation was also conducted into the analysis of macadamia leaves at various times of the year, as well as of younger or older leaves on the trees. The results show that the concentration of elements in the younger leaves was in all cases more variable, and that this was possibly related to the development of the fruit. The concentrations of the elements nitrogen, phosphorous, magnesium, zinc and iron in the young leaves decreases from fruit-set until the ripening of the nut in January.

A highly significant positive relationship was also found between the elements nitrogen, phosphorus, iron and zinc in the young leaves throughout the season. The most suitable time for taking samples of the macadamia appears to be October/November for the younger leaves.

VEGETABLES

Production trends

On the whole there was very little change in the production pattern of fresh vegetables as far as the mass and turnover go. The major portion of the production is still delivered to local municipal markets. Surpluses and shortages, often following hard upon each other, remain an important feature of the industry. At such times variations in quality become especially noticeable.

Unfortunately many producers still aim at quantity rather than quality. The fact that the South African consumer is so slow to make his objections to low quality heard encourages many beginners in particular to send numerous consignments of uncertain quality to the markets.

Among the small changes that occurred in specific areas are the increase in the production of cabbage in Natal and the Eastern Free State, onions, carrots and asparagus in the Southern Free State and Griqualand West, sweet potatoes in the Western Cape, and canning beans in the Eastern Transvaal.

A small but determined start has been made with the export of fresh vegetables by air, and this practice is

gradually increasing. The Western Cape and, to a lesser extent, the Transvaal took the lead with crops such as green beans, sweet peppers, egg fruit, asparagus and muskmelon.

The Transvaal Agricultural Union made important progress in the Transvaal this year in its attempts to arrange large, well-organised exports. The requirements with which these products have to comply are strict, but in certain cases quality standards have not yet been finalised. However, the existence of standards will ensure that producers become conscious of quality more quickly.

Factory processing of vegetables is still increasing. A severe shortage of green peas had to be supplemented by means of imports last year. Factories are now trying to encourage production in various areas in succession by means of micro- and even meso-climatic differences. The Sterk River and Sand-Vet areas are, for instance, now being investigated. In the case of peas this tendency has continued with the increase in mechanisation.

The canning of green beans took a great step forward with the importation of mechanical pickers. Where these pickers are used the preparation of the seed bed, planting, cultivation, irrigation and the choice of cultivars require special attention.

The drop in wool prices has led to an interesting tendency. It appears from the numerous enquiries received by the Horticultural Research Institute that many wool farmers are trying to supplement their incomes by means of vegetable production on the irrigated land at their disposal.

In all, 5,2 million kg of vegetables were exported during the year under review under cover of 328 phytosanitary certificates. By far the majority of these exports consisted of garlic and onions.

Marketing

Onions — Onion exports to Europe did not go very well this year, but fortunately the local market was good. The poor performance of South African onions on European markets was caused by the considerable increase in onion production in Europe and by the drop in the quality of South African onions.

Musk melon — When the practical side is taken into account it appears that exporting musk melons by air would be uneconomic, but the exceptionally high prices obtained in Europe indicate that this conclusion is incorrect. The cultivar Safogen fetched up to R8,00 per case of six fruit.

Sweet peppers — A quantity of sweet peppers was exported to Europe last year, chiefly by air. Apparently

there is still a number of problems to overcome, such as fungal spoilage, wilting and standardisation with regard to quality and packing.

Chief problems

A very old problem in vegetable production became of major importance again during the past year, viz the adverse effect on the health of crops of over-abundant summer rains, overcast weather and high humidity of the air. Fungal and bacterial diseases did great damage, especially to tomatoes, cucurbits and beans, because control measures cannot provide adequate control under these unfavourable conditions.

Among the most important diseases that occurred were late blight of tomatoes *Phytophthora*, downy mildew of cucurbits *Pseudoperonospora cubensis*, black rot of crucifers *Xanthomonas campestris* and brown rust of beans.

Poor quality seed is often offered for sale by the trade. Enquiries and complaints from farmers show that this problem was a serious one during the past year. The vegetable producer always discovers that the seed is of poor quality too late, after he has incurred all the costs of production. In order to assist farmers with this difficulty, the Horticultural Research Institute is trying, by means of sound and sustained selection of the best strains, to make good foundation seed for various crops such as onions, musk melons, peas, cabbage, beetroot and beans available to the Division of Seed Control for multiplication.

Although the *Pythium* species seldom cause problems in vegetable crops grown in the Transvaal, cases of *Pythium* infection in squashes occurred during the past season. During the past two winters (1971 and 1972) the heads of certain cauliflower cultivars planted for seed multiplication in the glass-house were infected with *Alternaria brassica*. Only cauliflower in glass-houses was affected, but this is the first time the disease has been reported in South Africa, and is an indication that under the right conditions the problem could occur in open-air plantings.

Tomatoes

Tomatoes remained the chief vegetable crop. The most important production areas, especially in the Transvaal and Natal, had one of the wettest seasons in years during the past summer. These conditions not only made the control of diseases virtually impossible, but even led to waterlogging on certain farms. In Natal serious *Botrytis cinerea* infections on fruit increased.

The yield of marketable fruit was far below average, which meant above-average prices on fresh markets. In the Lowveld many of the factory tomatoes were also diverted to the fresh market.

The cultivar Creole, which is supposed to be resistant to tobacco mosaic, yielded promising results on the Lowveld with regard to appearance, yield and quality. The new cultivars Venus and Saturn showed fairly good fruit qualities and were resistant to bacterial wilt *Pseudomonas solanacearum*.

Cultivar trials in the Transvaal Middleveld were carried out under exceptionally unfavourable conditions. Roodeplaat Albusto produced the highest yield (34,7 tons per ha), but this was not significantly better than the yield of the breeding strain 1372-3 (31,0 tons per ha), the breeding strain 1260-1-1 (30,8 tons per ha), Campbell (30,8 tons per ha) and Manapal (28,8 tons per ha). Creole produced a very poor yield.

The most popular cultivars still appear to be Manapal, Red Kaki and St Pierre in the Transvaal, and Homestead 61, Manapal and Roodeplaat Premier in Natal. Cultivar trials in the Western Cape showed that Pearson, Heinz 1370 and Moneymaker produce the best results there.

Breeding work on tomatoes to produce better and better types for the fresh market and for canning is being carried out at Nelspruit and Elsenburg under the guidance of the Horticultural Research Institute at Pretoria. At Nelspruit researchers are concentrating chiefly on canning types. Two promising strains, viz L1028 and L1026, are already being compared co-operatively with Roma and other commercial types.

The canning quality of nine samples of breeding strains was tested by a canning factory and outstanding results were obtained with several breeding strains. A dwarf market tomato, 58-1-3, which is resistant to nematodes, again produced promising results and is being tested in spacing trials.

Fertilising – Fertilising trials carried out during the past year showed the following:

- Phosphate fertilisation applied more than three weeks after planting is not as effective as when it is applied earlier.
- Phosphate fertilisation applied around the plant roots at planting has an adverse effect on crop mass, and it is better to keep the phosphate away from the roots.
- Leaf spraying with nitrogen fertilisers applied to plants that had received normal fertilising in the soil had no effect on the crop mass, although vegetative growth was much better.

Weed control – The chemical control of weeds on transplanted tomatoes was continued in a trial using 10 cultivars. Of the preparations tested, metribuzin controlled the weeds that occur at Roodeplaats very effectively without damaging any of the cultivars.

Diseases and pests – Grey mould, caused by the fungus *Botrytis cinerea*, was first identified as a problem of summer tomatoes in the Natal Region during the previous season. Under the cool, moist conditions of the 1971/72 season the disease became more prevalent and widespread. Fruit rot was the main symptom on some cultivars, while on others the ghost spot stage predominated.

None of the fungicides used by farmers in their normal spray schedules had any significant effect on the causal fungus.

Tomato virus – During the summer of 1972 a tomato sample that was infected with a virus was received from a vegetable farmer. Isolation showed a virus mixture of the tobacco mosaic virus (TMV) and an elongated virus. On further investigation it appeared that the TMV isolate was not the usual one, but was more like one of the TMV strains.

The elongated virus produces an interesting pattern of yellow spots on *Nicotiana tabacum* w. *Xanthi*. The virus concentration was very low. Preliminary electron microscopy showed that the virus falls into the 750 mμ length class.

An antiserum against the virus is being prepared at present and it is hoped that this will help with the final identification of the virus.

Attacks by the potato tuber moth *Phthorimaea operculella*, an important tomato pest, caused crop losses of as much as 40 per cent in cases where adequate control measures were not applied. In the Olifants River area the damage was particularly noticeable in autumn.

The effectiveness of monocrotophos and methomyl against this pest was again confirmed experimentally. The spreading of wasp parasites of the potato tuber moth in this area was continued.

As in the previous year, the tomato rust mite *Aculus lycopersici* again reached pest numbers in the Olifants River area in late summer and autumn. Where inadequate control measures were applied, there was untimely defoliation of plants, with the result that damage to the fruit by sunburn occurred and the crop was smaller. Monocrotophos and methomyl were again effective against the pest.

Onions

The local market for onions was exceptionally good, which did a lot to counteract the export problems of the past few years. Last season South Africa exported onions to Japan as well. The Japanese prefer big onions with no purple tinge.

The attempt to produce better quality Caledon Globe and Australian Brown by selection is being continued at Elsenburg. The purpose is to continue to improve the source of foundation seed.

It is apparent from evaluation trials carried out at Elsenburg and Riviersonderend during the past two years that Texas Grano is the most acceptable early cultivar for the Western Cape, provided it is sown during the first half of March. Caledon Globe produces the highest yield and quality there when it is sown during the first half of May.

The new onion cultivar Atjar, bred by the Horticultural Research Institute, was placed on the varietal list during the past year and breeders' seed was issued for multiplication. This white onion was specially bred for pickling or chutney and has already undergone very successful factory tests.

Spraying trials on onions have shown that the best control of downy mildew *Peronospora destructor* may be obtained with a spraying mixture containing fentin hydroxide and maneb. The addition of biofilm as a wetting agent further improved control.

Green beans

Sprinkler irrigation for green beans became more important during the past year.

Trials aimed at determining the effect of sprinkler irrigation on the incidence of bacterial blight and other leaf diseases such as brown rust were continued. Over-abundant rain during the trial hampered the work and probably cancelled out any possible differences between sprinkler and flood irrigation.

No differences were observed between irrigation treatments with regard to either bacterial blight or rust.

Green beans are an important crop in the Western Cape where they are planted for fresh marketing, canning and quick freezing. Trials carried out there show that Wintergreen and Seminole did very well, but did not qualify for the fresh market on account of their black seeds. Gallatin 50 and Bonvert are acceptable for freezing, but Bonvert is unfortunately sensitive to halo blight.

For production for the fresh market the Horticultural Research Institute's own cultivar

Wintergreen was excellent in respect of yield, resistance to disease, earliness and pod quality. The young pods in particular are of superb quality and are very successfully exported to Europe by two producers. Wintergreen was so well received on the overseas market that some markets want a supply of about fifteen tons a week, which again confirms the value of this cultivar for production for fresh marketing.

At present the cultivar Gallatin 50 is the most suitable for processing since the plants are suitable for mechanical harvesting. The mechanical harvesting of green beans has become an established practice in South Africa too and is already practised in places such as the Marble Hall and Groblersdal areas, where green beans are planted for processing on a large scale by producers in co-operation with canning firms.

Green peas

The requirements of the mechanical harvesting process and the canning industry necessitate an intensive research programme to find the most suitable cultivars. The evaluation of the most promising cultivars was continued at Roodeplaat and Elsenburg. It is clear from the results obtained so far that the ideal cultivar has not yet been bred. All the cultivars suffer from the same defect, viz that they lodge during the reproductive stage.

It was also clear from the results that Cape Freezer and Mingo Mark with 82 per cent, Strain 1068-1B with 79 per cent, Greenfeast with 75 per cent and Vitalis with 72 per cent produced the highest percentage of pods and the highest total yield from a single crop. Unfortunately Mingo Mark's seeds are rather big, but Vitalis and Cape Freezer are considerably better. Greenfeast and Strain 1068-1B were the best as far as seed size goes.

On the other hand the cultivars Yanco Packwell and Yanco Choice had beautiful small seed, but their yield was too low in comparison with the other cultivars. The seeds of other well-known cultivars that yield well such as Vitalis, Scout and Lancet were considerably vigger than those of Greenfeast.

At Roodeplaat Greenfeast produced its highest percentage of mature pods 46 days, Cape Freezer 46 days, Strain 1069-1B 61 days, Vitalis 44 days, Scout 61 days and Mingo Mark 68 days after the first flowering.

Sweet potatoes

The stable demand for sweet potatoes continued. Consumption is gradually increasing among the Bantu. However, it is striking that so few sweet potatoes are grown in Natal with its large Bantu population. There appear to be considerable marketing problems there.

Difficulties are experienced in Natal in obtaining suitable planting material of the latest cultivars. In the

Western Cape where the cultivar Borrie has always been very popular trials have shown that Koedoe, Impala, Wildebees and Brondal, which were bred by the Horticultural Research Institute, produced better yields and were very well adapted there.

Virus purification — Four sweet potato cultivars were purified of harmful viruses at the Horticultural Research Institute by means of heat therapy and meristem growing point culture techniques. When indexing was applied it was found that Mafutha and Hoenderspoor were still carrying a latent, symptomless, virus infection, but that Eland and Impala are at present free from any known virus. Production trials with treated Mafutha and Eland show that the improved sweet potato produces a considerable increase in yield.

Virus-free runners of the cultivars Mafutha, Borrie and Griekwa were issued to growers in the Lowveld and Western Province in January 1972. A small quantity of virus-free material of Eland and Impala is being multiplied and researchers hope to be able to release it at the end of 1972.

Although many complaints are received from the sweet potato industry that the cultivar Impala has deteriorated a great deal as a result of virus infection, it has always produced very good crops at the Horticultural Research Institute. However, it is clear that the cultivar has a virus infection and every effort is being made to purify it.

In the Southern Cape the sweet potato beetle *Conchyloctenia punctata* occurred in pest numbers during the past season. Experimental results showed that the larvae of these insects can be fairly well controlled with preparations such as endosulfan, carbaryl, tetrachlorvinphos or trichlorfon. However, none of these preparations could control adult beetles successfully.

Nitrogen fertilisation trials with sweet potatoes at the Horticultural Research Institute show that sweet potatoes respond very well to nitrogen fertilising on less fertile soils. Results show that optimal crops are obtained when the sweet potato leaves have a nitrogen content of from 5 to 5.5 per cent.

Cauliflower

Trials aimed at investigating the problems experienced in growing cauliflower were continued at the Horticultural Research Institute.

Seeding time trials confirmed previous observations that the longer sowing is postponed after February, the less successful it is. It was also found that late cultivars like Snowcap and Canberra produced better yields than early cultivars like Cumulus, Snowball and Snowdrift.

All sowings from April to October failed completely—possibly because of the low winter temperatures and short days during winter, and later because of over-abundant rain, high spring temperatures and an epidemic of a bacterial leaf disease *Xanthomonas campestris* var. *aberrans*.

Breeding — Cauliflower breeding was continued and the existing breeding strains were tested for a further generation. Twelve further selections were made from the most promising species and their seed was harvested. Some selections that have already reached the seventh and fourteenth generations are promising and the second and third generations of further crosses are also good.

The cultivar Cumulus was exceptionally susceptible to the bacterial disease *Pseudomonas maculicola* during the past two years and consequently produced poor results. Since most of the other very early cauliflower cultivars appear to be very sensitive to this disease and to certain nutritional deficiencies, it was decided to concentrate in breeding programmes on mid-season cultivars that are more resistant and yield better, rather than on early season cultivars.

Cabbage

Cultivar and sowing time trials carried out at Elsenburg during the year showed that the best sowing time is from November to January, and sowing between March and May produces the poorest results. However, C.G. Cross, N.S. Cross and C.O.H.R. Cross still produced fair yields when sown between March and May. Copenhagen Market and O.S. Cross gave good results when planted in early summer.

In Natal, cabbage is the most important vegetable crop and N.S. Cross and Glory of Enkhuizen are the most popular cultivars. Deficiencies of the trace elements boron and molybdenum are common in Natal, but fortunately most producers are aware of this and take the necessary precautions in good time.

There are no serious insect pests apart from cutworms and the diamond-back moth. Downy mildew *Peronospora parasitica* may become a serious pest in seed beds.

The bacterial leaf disease thought to be caused by *Xanthomonas campestris* var. *aberrans* is still spreading on cabbage grown in the Transvaal.

Carrots

There are indications that the demand for and consumption of carrots is increasing. Enquiries and reports from various regions indicate that the crop is grown on a large scale.

Canning factories take large quantities which are canned in the form of dice and rings. A new trend, viz the whole-canning of small types, had its origin in Europe, but local manufacturers are not adopting this practice at the moment. At present expensive seed and high production costs make whole-canning even less economic than the canning of the ordinary standard cultivars.

The sale of carrots on the fresh market has also received a new stimulus from the exceptionally high prices paid during the year. Organised Agriculture is at present investigating the possibility of packing and selling carrots in standardised containers.

The only big dehydration factory is taking large quantities annually. Cultivars with a good dry ratio are important for this industry. It appears from trials carried out at the Horticultural Research Institute that of the eleven cultivars tested for dry matter, Cape Market with a dry ratio of 6,7:1, Chantenay—7,1:1—and Formula—6,4:1—are the best.

Pumpkins

Baby marrows, which are the very young fruit of the old, well-known vegetable marrow, are becoming a much sought-after delicacy on the local as well as the overseas markets. For many years both the producer and the consumer showed little interest in this crop.

In view of the projected export by air of baby marrows to Europe and the lack of knowledge about the crop, five of the best known cultivars were evaluated in cultivation trials. It appears from the results that the crop responds well to spacing and that the highest yield of desirable quality is obtained with the cultivars Black Zucchini (23,3 tons per ha) and Cazerta (20,2 tons per ha) at a spacing of 1,2 m by 0,61 m.

According to overseas market reports the European consumer prefers the dark green types such as Zucchini, whereas only Cazerta is popular on the local market at present.

The most important diseases to be guarded against are mildew, downy mildew and mosaic, and pumpkin flies and aphids are the chief insect pests.

Cucumbers

A keen demand for this crop is developing throughout the year, particularly during the cold winter months. Many producers in the Lowveld obtain the highest average prices during the winter months. Market prices fluctuated between R1,50 and R3,00 per 10 kg bag for virtually the entire winter.

According to the results of cultivar trials carried out at Nelspruit, Cherokee (27,3 tons per ha) and

Fletcher (23 tons per ha) produced the best yields, and are also well-adapted as far as diseases go. The results of a similar trial in Pretoria using seed from the same source showed that the well-known Early Fortune (32,2 tons per ha) and an exported sample still being tested under cold conditions (28,2 tons per ha) did by far the best.

Bitter cucumbers

The breeding of a cucumber with a high bitter principle content is continuing and the sixth generation of the breeding strain Ashley x Hanzil has been reached. The selections 3/4, 3/19 and 4/33 seemed promising, with an average bitter principle content of about 47 mg of cucurbitacin C per 100 g of fruit flesh, as against approximately 20 mg of bitter principle per 100 g of fruit flesh, which the original female parent Hanzil produced.

Bitter principle is important because it has great pharmacological potential.

Asparagus

The demand for canned asparagus still exceeds the supply. The export of fresh asparagus by air is receiving sporadic attention and can be economic. The Horticultural Research Institute is at present evaluating the best cultivars imported from America and Europe.

The entire industry in the Republic still depends on the first two standard cultivars, viz Mary Washington and California 500.

Lettuce

Outbreaks of bacterial leaf spot of lettuce, caused by *Xanthomonas vitians*, again occurred in the Natal Region last winter. The cultivar Great Lakes appeared to be more susceptible to the disease than the cultivar New York.

The possibility that certain weeds may serve as additional host plants for this pathogen is being investigated at present.

Garlic

Interest in garlic for both the local and export markets is increasing. Since no control trials have been undertaken with this crop in the Republic, and investigation into the cultivation of garlic was started at the Horticultural Research Institute.

Sweet peppers

This crop, which used to be entirely unknown, has become very popular overnight. The consumer appears to acquire the taste very quickly, especially when it

becomes known that sweet peppers have the highest Vitamin C content of all vegetables. In Europe sweet peppers are particularly popular in mixed salads. Its low mass makes the fruit suitable for export by air.

The few evaluation and cultivation studies carried out by the Horticultural Research Institute indicate that this crop has fewer problems than its relative, the tomato. Good yields of 25 tons or more per ha may be fairly easily obtained.

There are various cultivars that produce fruit of equally good quality and equally high yield, such as California Wonder and related strains such as Yolo Wonder, Florida Resistant Giant and Keystone Giant.

All sweet peppers are very sensitive to sunburn.

Muskmelons

The breeding, selection and evaluation of muskmelons, especially of those intended for overseas markets, was continued. Most of the overseas cultivars adapt well in the Western Cape, but the Republic has one great limitation vis-à-vis Israel and the countries of Southern Europe: the very long distances and expensive air freight charges to Europe. However, the keeping and travelling quality of the very popular cultivar Haogen is so poor that it can be exported from South Africa only by air.

Research workers are, therefore, trying to improve Haogen and other cultivars to such an extent that they can also be shipped.

Watermelons

Watermelons are grown on a large scale each year by a fairly small number of producers. There is a lively demand on the markets during the summer months, especially during the Christmas and New Year holidays. Congo and Charleston Grey are the most popular cultivars.

In a cultivar trial carried out at the Horticultural Research Institute, F1 Top Yield (65 tons per ha), Charleston Grey (60 tons per ha), Garrisonian (59 tons per ha) and Congo (55 tons per ha) produced the highest yields, and Blue Ribbon (25,7 tons per ha) gave the lowest yield.

High sugar content is an important quality characteristic in watermelons. In this respect the following cultivars did best: Blue Ribbon (12 per cent), Charleston Grey (11,5 per cent), Congo (11 per cent) and F1 Top Yield (11 per cent). In all cultivars the sugar content was 1 per cent higher on the average at the crown than near the rind.

6. The Livestock Industry

BEEF CATTLE

Production trends

There has been a considerable increase in the slaughtering of stock over the past decade in spite of the fact that, in the case of cattle, there was a decrease in the number of live animals. The increase in the slaughtering of cattle from 1969/70 to 1970/71 was 12,7 per cent.

During the year under review the Republic imported about 390 000 head of cattle and cattle carcasses from South West Africa and other neighbouring territories. These imports have increased dramatically during the past five years (305 per cent) and constitute 14 per cent of all cattle slaughterings in South Africa.

The Republic cannot supply all its own beef requirements. The increase in beef production does not even keep pace with the increase in population.

Changes in the industry indicate that attempts are being made to solve production problems. Crossbreeding is increasing, with consequent higher calving percentages, faster growth, greater mass at weaning, etc. Fast-growing lean-meat types are being used more and more in crossbreeding programmes.

Intensive fattening on a high energy ration is increasing as the gap between maize prices and meat prices shrinks. Intensive patterns of production are becoming more general, and the scale is the most important single factor in attempts to increase meat production effectively.

In the Winter Rainfall Region there are three interesting trends to be observed in the production of beef:

In the first place there is a hitherto unknown interest in the keeping of beef cattle breeding cows and also a real expansion in the breeding of beef cattle. In the second place a large expansion is noticeable in the specialised concerns that finish oxen for the market in feeding pens in the vicinity of Cape Town. It is estimated that 6 to 8 per cent of the cattle slaughtered at the Maitland abattoir during 1971 came from these feeding pens.

In the third place there was a clearly visible expansion in the number of concerns utilising weaner calves for the production of meat from the dairy herd. The experimental work on the early weaning of dairy

calves carried out at Elsenburg and Welgevallen over the past few years has made a real contribution in this connection.

Although slaughter stock in the Eastern Cape Region is mainly marketed straight from the veld, finishing in feeding pens (for weaner calves as well) is receiving more and more attention. This is the case particularly in the sour grassveld regions with a high rainfall where the production of feed can be practised successfully. In the sweetveld parts successful finishing in the veld is possible and rewarding.

A definite trend to market animals at a younger age is noticeable. The advantage of higher production of milk by breeding cows for the growth of the calf is clearly shown when dual purpose bulls are used on beef cows with a view to using the crossed heifers as breeding cows.

A handful of farmers who feed beef cattle on a large scale are found in the Highveld Region, but the intensive feeding and finishing of slaughter stock is not yet generally practised.

The prejudice against oxen of the large milk and dual purpose breeds is not longer so strong and more and more of these types are found in feeding pens nowadays.

There is a noticeable improvement in the level of beef farming throughout the Transvaal Region. Better utilisation of the pasturage by means of correct pasturage management practices, better stock management practices and the use of urea licks are becoming general. Oxen are marketed at an earlier age and there is less crossbreeding.

During 1971 the record number of 500 000 head of cattle and carcasses was exported from South West Africa and slaughtered locally. This is an increase of about 21 per cent over the previous year.

A comprehensive and thoroughly organised new marketing scheme was successfully launched in South West Africa in 1971. For marketing in the controlled areas a quota for a period of 6 months is given to every meat producer in advance. This enables the producer to plan his farming properly, and also encourages marketing throughout the year which can, to a large extent, be achieved by correct veld management. But the biggest advantage of this scheme is that producers who exceed their carrying capacity are penalised, and that the scheme in this way effects soil and veld conservation.

These Friesland tollies were finished at the Dohne Research Station on a ration containing 30 per cent chicken-coop manure. One half of the carcasses were graded Prime A and the other 50 per cent, Grade 1A



Beef cattle performance testing scheme

The National Beef Cattle Performance and Progeny Testing Scheme is gaining more and more acceptance, and there are several breeders' societies that want to make performance testing compulsory for all their members. The total number of members participating in this scheme is at present 651, and 822 herds have been entered.

Plans have been drawn up for the erection of two new bull stables at Queenstown and Vryburg and the transfer of control over the Omatjenne bull centre to the Animal and Dairy Science Research Institute.

A total of 102 397 masses was measured, an increase of 18 284 over the previous year. This increase can be ascribed to a good season and the increase in the number of members.

The number of breeding cows subjected to performance testing is about 100 000, which represents five per cent of the total female beef cattle population — still a very small part indeed.

The past year was characterised by good rain over most parts of the country so that the weaning masses were considerably higher than in previous years. In several cases weaning masses of 300 kg were achieved

without any creep-feeding or supplementation.

The fact that members must now have their own scales, expedites the implementation and expansion of the scheme.

The Meat Board has allocated funds for the erection of testing facilities at Vryburg and Queenstown, and consequently the growth tests of bulls in standardised conditions (Phase C) will soon be considerably expanded.

A total of 2 242 bulls has already been tested under Phase C of the scheme. The utilisation of the facilities was as follows over the past two years:

	Available places	1970	%	1971	%
Irene	410	352	86	348	58
Queenstown	200	147	74	116	85

The poorer support at Queenstown can be ascribed to drought conditions.

During the past three years the following breeds have been very well represented at these tests. (The total of bulls tested and their performance are summarised in the following table):

Breed	Number	Final mass	A.D.I.	Range	A.D.A.	Feed consumption
Afrikander	214	409	1,09	0,79 — 1,64	0,82	7,88
Brahman	155	491	1,29	0,87 — 1,80	1,00	7,49
Hereford	110	488	1,33	0,95 — 1,69	1,02	7,25
Pinzgauer	102	559	1,46	1,01 — 1,89	1,09	7,15
Simmenthaler	271	568	1,47	0,98 — 2,00	1,14	7,47

A.D.I. = Average daily increase

A.D.A. = A.D.I. per age in days

The remaining beef breeds were represented to a lesser extent.

A characteristic of the results is the reasonably large variation in growth potential within each breed.

The growth testing of bulls on the farms of their owners (Phase D) has already reached the end of its first year. Each breeder is required to have a minimum of 15 bulls tested. The advantage of these tests is that the breeder himself must keep an eye on his bulls and can make up a ration from the available feed on his farm. The general trend is that a ration should contain 12 to 14 per cent of crude protein with about 50 per cent of roughage. The possibilities of this phase are very good.

Of the 268 bulls at the beginning, 240 completed these tests.

Blood groups

Blood group tests and serum-typing were carried out on 1322 head of cattle, and the following conclusions were arrived at:

Paternity determinations — 101 cases were received, 92 of which could be solved (91,1 per cent).

Possible identical twins — 15 pairs were tested, 3 of which were identical. Two sets of triplets were also tested during the year and they were not identical.

Fertility — 30 bull/heifer twins were tested to trace free-martinism as a result of blood mixing. In five cases there was no blood mixing and those heifers are thus potentially fertile. One set of triplets consisting of two bulls and one heifer were sent in and it was found that the heifer was sterile.

Altogether 136 bulls were tested for record purposes. They were mainly bulls whose semen is stored and A.I. bulls.

One case was received where the farmer was convinced that one of his calves was a cross between a cow and a wildebeest! By testing blood samples of the calf and its mother, it was found that the calf was not a cross.

The Department participated in the international comparison test in which reagents from various countries are compared. The results were satisfactory.

Breeding

The three most important production systems for farming with beef cattle under extensive conditions are the sale of weaner calves, the sale of store oxen at about 18 months and the marketing of slaughter oxen from the

veld at about 3½ years and older. At the Mara Research Institute the relative economic importance of the various production characteristics in these production systems was calculated.

Calving percentage is one of the most important factors of gross income in all three production systems. Pre-weaning growth also has great economic significance in the sale of weaner calves. The importance of pre-weaning growth or weaning mass decreases when the oxen are marketed at a later age. In the sale of store oxen and slaughter oxen from the veld post-weaning growth and calving percentage are the two most important factors of gross income.

In veld conditions at Mara it was found that weaner calves with a large body mass maintain their advantage in mass although they grow no faster after weaning than weaner calves with a small body mass. For this reason a high weaning mass is important, even if oxen are only marketed at 4½ years.

At Mara and Messina there is, under veld conditions, little difference in the increase in mass between the different breeds and crosses that have already been compared. Characteristic of all the comparisons is that the breed or cross with the best weaning mass maintains that advantage. Apparently the feeding level on veld grazing is too low for oxen to be able to realise their inherent growth potential to the full.

It would appear that breeds and crosses with a good growth potential can gain at a rate of about ten per cent faster than the average on good veld grazing. On poorer veld grazing the differences are smaller. For greater increase in growth the solution lies rather in veld improvement than in the further genetic improvement of beef cattle.

The influence of the feeding level, age and breed on the appearance of oestrus and ovulation in dry beef cows was determined for Afrikander and Hereford cows and heifers with normal and submaintenance feeding rations over a period of three months.

Although the results indicate that oestrus is observed less regularly in the Afrikander (possibly as a result of the short duration of oestrus in this breed), it would appear that a low feeding level does not play a very important role in the breeding potential of the dry cow. Earlier research showed that abnormalities in ovulation may be an important cause of infertility in cows.

The connection between the growth rate and adrenal and thyroid activity of Afrikander and Simmenthaler bulls was investigated under performance test conditions. Blood from the bulls was analysed for

cortisol and thyroxin and it is clear that the Afrikander had a lower thyroxin and a higher cortisol level than the Simmenthaler bulls. There was also a tendency for the growth rate of both breeds to show a positive connection with thyroxin and a negative connection with cortisol.

In a cross-breeding trial with Jersey cows the meat quality of cross-bred steers was compared with that of pure-bred Jersey steers. The meat of the cross-bred oxen was evaluated by a trained panel of tasters and no statistical differences could be determined for the various criteria, viz juiciness, tastiness, flavour and tenderness. Physical softness tests done with laboratory instruments confirmed the conclusions of the panel of tasters.

An obvious difference is that a statistically significant larger amount of fat was found in the muscles (graining) of the Hereford crosses (5,3 per cent) than in the muscles of the Simmenthaler (4,1 per cent), Brown Swiss (3,2 per cent) and Charolais (2,5 per cent) crosses. These differences in the intramuscular fat of the four crosses was also confirmed by the total amount of fat found in the carcasses, viz 29,1 per cent, 24,2 per cent, 20,7 per cent and 21,0 per cent respectively. This very clearly illustrates the more effective production of red meat by the last three crosses than by Hereford crosses, especially in the light of the fact that the panel of tasters did not find the fatter meat more acceptable or more tender than the leaner meat of, for example, the Charolais crosses.

At Welgevallen young Simmenthaler x Afrikander cross oxen that had, after a year on a grain farm, been finished intensively in the feeding pen for sixty days, gave an average live mass of 457,2 kg with a carcass mass of 249 kg and were on the average graded Super.

At the Vaalharts Research Station it was found that the increased vigour of Brahman, Charolais, Hereford and Simmenthaler crosses in the veld as against pure Afrikanders at 30 months of age showed an average hybrid vigour effect of 20 per cent. The same tendency was found in the feeding pens where the animals had been fed for 118 days and slaughtered at 20 months.

The Charolais crosses show the highest average hybrid vigour in respect of growth in both production systems, but give by far the highest percentage of problem cases at birth because the calves are large and heavy. The Brahman crosses do particularly well in extensive conditions with excellent growth potential and carcass quality (based on grading).

Interesting results were also obtained at Vaalharts with the production of slaughter stock from the Jersey cow. The percentage of calving problems among Jerseys was lower than among Afrikander cows and very much

better results with A.I. were obtained with Jersey cows in veld conditions than with Afrikander cows (15 per cent).

The post-weaning growth of Jersey crosses on veld was better than that of pure Afrikanders. Even in the feeding pen Jersey crosses performed better than Afrikander crosses, but the Jersey crosses produce a carcass of poorer quality as a result of the poorer grading and higher percentage of fat around the intestines.

Pure Afrikanders and cross-bred Afrikanders were covered at two ages, viz at 20 months and 26 months (one year's figures). At the later age (26 months) no difference has to date been found between the various groups, but at 20 months a considerable improvement was found among the first crosses. Only 32 per cent of the pure Afrikanders were found to be with calf as against the average of 78 per cent for the first crosses.

Feeding

The fattening of Simmenthaler steers at weaning age is producing excellent results. Steers finished on a high energy ration in feeding pens easily achieve the best grades at 11½ months. In 1971 twelve such steers were slaughtered after a feeding period of 4½ months. Ten of the twelve achieved Super grade, and an average profit above feeding costs of R34 per head of stock was realised.

Simmenthaler oxen taken to the feeding pens at 18 months achieved excellent grades after a feeding period of two months. Since the more intensive system results in less stock being carried on the veld, finishing of weaner calves deserves special attention.

Average daily gains of about 1 000 g were achieved with Friesland calves fed on a maize silage ration plus a protein supplementation for 200 days until the age of 13 months. Increases were slightly higher for bulls than for oxen, but the carcass conformation and fleshing of oxen and bulls were very satisfactory.

A study of the meat production capacity of eleven different breeds at the Omatjenne Research Station leads one to conclude that feeding and management are greater problem areas in the economic production of beef than breeding is.

The average calving percentage of these breeds was 79 per cent, while certain breeds maintained an average of 86 per cent over a period of 12 years. Rainfall, however, has a statistically significant influence on calving percentage, and calving percentages may vary from 56 per cent to 90 per cent, depending on the rainy season.

In the environmental conditions of the cattle grazing regions of South West Africa economic

Carcasses of Friesland tollies finished on a ration containing 20 per cent chicken-coop manure. All were graded Super A and the excess of profit over feeding costs was 30 per cent higher than with the customary fattening ration



production may be achieved with any of the following breeds: Simmenthaler, Hereford, Afrikander, Brown Swiss or Pinzgauer. The Santa Gertrudis also does very well in the Region.

One of the most important problems in beef farming in the Northern Transvaal Bushveld is to get the young heifer or ox to grow out after weaning so that it can reach the required body mass at an early stage in order to begin regular reproduction (in the case of the heifer) or be marketed as soon as possible without excessive feeding costs (in the case of the ox).

At the Mara Research Station these problems are being investigated with oxen of different breeds and crosses.

Results obtained over the past three years have shown that creep feeding that immediately precedes finishing has no advantage. There was very little difference in the required number of days in the feeding pen to reach the super grade, the total intake of feed and the final mass before slaughter between animals given creep feed beforehand and the control group.

Of all the different breed groups and cross groups the biggest difference in mass gain was observed in a comparison of the Hereford (with a daily increase of 0,99 kg) with the Afrikander (with an increase of 0,67 kg). The variation within the breed groups or cross groups was very large.

The provision of a concentrate which provided about one half of the energy and protein requirements of weaner steers on dry winter grazing led to the body mass of the supplemented steers being up to 52 kg larger than that of the control animals at the end of the summer, one year after weaning.

Cross oxen, supplemented as well as control animals, showed the highest daily mass gain on veld grazing (0,36 kg and 0,24 kg respectively). Among the control animals the Hereford and Simmenthaler showed the lowest gains (0,11 kg and 0,15 kg respectively), while among the supplemented animals the Afrikander grew the poorest (0,27 kg).

The results, collected over two years, therefore indicate that the provision of a concentrate to weaner steers on winter veld grazing cannot contribute profitably to an increased rate in the provision of high quality beef from the sweet bushveld regions of the country.

A herbage cutting trial to determine the production potential of different veld types has been initiated in Southern Natal.

The results of the first year indicate that different veld types vary mainly in the production of herbage bulk and to a lesser extent in the nutrient value of the herbage produced. Cutting at eight-week intervals produced the highest herbage yields. The expected daily

gain of young grazing animals from such herbage varied between 0,47 kg and 0,65 kg for the different veld types, while the theoretical carrying capacity varied from 1,0 to 2,5 ha per large stock unit (500 kg).

The average area required per large stock unit for the different intervals of cutting are:

4 weeks interval – 2,1 ha; 6 weeks interval – 1,9 ha; and 8 weeks interval – 1,6 ha.

The limiting nutrient for young growing animals in summer veld appears to be crude protein, while at the fattening stage energy becomes a limiting factor.

Work with oesophagal fistulated cattle and sheep showed that sheep constantly selected a ration higher in crude protein than cattle. The crude protein content of summer veld was 5,68 per cent, that of the feed selected by cattle 7,06 per cent and that of the feed selected by sheep 8,35 per cent.

The ration selected on winter veld with a crude protein content of 2,00 per cent crude protein was 2,8 in the case of cattle and 4,9 per cent in the case of sheep. The ability of sheep to select crude protein to such an extent is one of the reasons why sheepfarming has been and still is one of the main farming enterprises in the highland sourveld.

Management

Some slight progress can be seen in the application of improved management practices.

At the Soutpan Experimental Cattle Farm excellent results have been achieved since the change to the controlled, selective grazing system and the particular herd management practices that go with it. The calving percentages of cattle on this farm were on average only 56 per cent before the change, but have since risen to an average of 87 per cent. After the past covering season it was found that 90 per cent of the breeding herd had conceived – and this in very unfavourable conditions.

The weaning mass increased as dramatically – from 149 kg to 204 kg.

DAIRYING

Production trends

The number of cows and heifers over the age of two in the possession of Whites and the relation between

beef and dairy cattle varied as follows during the past two decades:

Year	Beef cattle	% of total	Dairy cattle	% of total
1949-1950	805 000	35,4	1 468 000	64,5
1961-1962	1 538 000	44,5	1 919 000	55,6
1970-1971	2 419 000	67,8	1 445 000	32,2

The proportion of dairy to beef cattle has reached a critical stage and milk shortages could follow unless further intensification is applied. That there has been greater efficiency in production and intensification during the period reviewed is clear from the fact that, although dairy cattle numbers have remained virtually constant since 1949-50, fresh milk production has increased by 22 per cent, cheese milk production by 72 per cent and condensing milk production by 154 per cent, whereas beef production has risen by only 19 per cent during the same period.

The fact that milk production has improved by 961 litres per cow per year during the past two decades is an indication of favourable trends in the industry. The total production of milk is 1 459 000 000 litres a year at present. The number of suppliers of cream has dropped drastically from 53 825 to 45 215 over the past eight years.

Suppliers of cheese milk increased from 6 130 to 7 153 over the same period and condensing milk suppliers from 5 625 to 7 868. The number of fresh milk producers remained static at about 2 750.

The production of cheese milk and powdered milk is expected to increase still further. The fact that many cream producers are changing over to beef production, especially in low rainfall areas, is considered a favourable development.

Over the period 1950 to 1971 the *per capita* consumption of fresh milk dropped by 22 per cent and that of butter by 11 per cent, whereas cheese consumption increased by 25 per cent and the consumption of condensed and powdered milk by 89 per cent.

Problems and progress in connection with milk production

Breeding: The increasing use of A.I. and a well supported milk recording scheme make progeny testing for bulls on a large scale possible. The Friesland breed is continuing to gain ground as the chief dairy breed, largely because of its contribution to beef production, and Jerseys are making an increasing contribution to beef production through crossing.

Feeding: The generally low level of nutrition on which production is based, which is a direct result of the poor nutritional value of the natural pastures, remains the most striking problem of the industry. There has, however, been a considerable improvement in the average production per cow and the consumption of dairy rations has risen by 13 per cent over the past 10 years, in spite of the reduction in dairy cow numbers.

Management: The fact that in most cases dairy farming forms part of mixed farming systems means that the necessary supervision and management of the dairy enterprise is not always satisfactory. Relatively few dairy farmers keep abreast of new knowledge and developments and many are consequently unable to make their dairy enterprise a profitable undertaking.

Mechanisation in the dairy industry is increasing all the time and within a year the percentage of fresh

milk farmers that use milking machines rose from 28 to 41. In all 38 per cent of fresh milk farmers already make use of milk tanks, and 7 per cent of all commercial producers use milk tanks for cooling.

The Milk Recording Scheme

The size of this scheme remained the same, although the efficiency of collaborating milk recorders increased.

This year 135 684 tests in respect of registered cows (butterfat and milk weights) and 271 894 tests in respect of grade cows were carried out; the corresponding figures for last year were 136 338 and 269 447. The number of herds served dropped slightly.

The average numbers of herds and cows tested per month are as follows:

HERDS				COWS			
Friesland	Jersey	Other breeds	Total	Friesland	Jersey	Other breeds	Total
448	291	154	893	20 327	9 155	4 482	33 964



Chemostatic apparatus used to adapt starter bacteria to growing in the presence of antibiotics. This photograph was taken in the Microbiology Section of the Animal and Dairy Science Research Institute

The monthly averages represent about 45 000 cows a year undergoing testing.

The emphasis was placed on control and the testing of new techniques to overcome problems in the present system.

Pilot scheme in connection with sampling by owners

This project is progressing satisfactorily. Results indicate that problems such as staff shortages, financial pressure, accuracy and speed could be eliminated if the present scheme were modified to allow the owner to collect the milk samples for each month and dispatch them to a central laboratory.

A total of 41 918 samples was sent to the central laboratory at Glen; 40 321 could be tested, 161 sample bottles were broken in transit and 287 samples were curdled and could not be tested.

On 100 different occasions 5 021 samples were collected for checks and the results were found to differ very little from the results of tests at the central laboratory.

On the average 37 herds took part in this investigation.

It took an average of eleven days from the time the owner took the sample to the time he received his processed data, whereas it takes about three months under the present scheme.

In the Western Cape the scheme was so successful that the amalgamated Transvaal and Boland A.I. Co-operatives are going to apply it on an extensive scale in order to carry out breeding tests on nominated young bulls.

Developments

During the year under review the Transvaal A.I. Co-operative started its own milk recording round, which will work under the same supervision and control as the milk recording co-operatives. The round consists of 12 herds from which 1 080 cows have already been entered for official milk recording.

These cows are all inseminated with prescribed semen from specially selected bulls in order to analyse the breeding value of the bulls.

During the year under review the Natal Milk Recording Co-operative amalgamated with the Natal A.I. Co-operative, which is progressing very well.

A.I. services expanded during the past year, particularly in herds used for milk recording, so that at present there are 273 herds with a potential of 27 300 cows where this breeding method is used.

Processing milk records

Milk records had been far behind as a result of the change-over to the computer, but were virtually brought up to date during the year under review. In addition to about 45 000 records normally dealt with in the course of a year, an additional 121 128 completed records were dispatched to collaborating farmers.

A summary of the records of registered cows tested during the past two years follows:

	1969/70	1970/71
Total number of records dispatched to farmers	15 735	16 069
Short lactations (unusual reasons)	11,4%	19,3%
Lactations on which averages were based	13 946	12 991
Average milk production per cow (kg)	3 792	3 732
Butterfat percentage	4,14%	4,18%
Fat-corrected milk per cow (kg)	3 872	3 833
Short lactations (usual reasons)	12,3%	13,3%

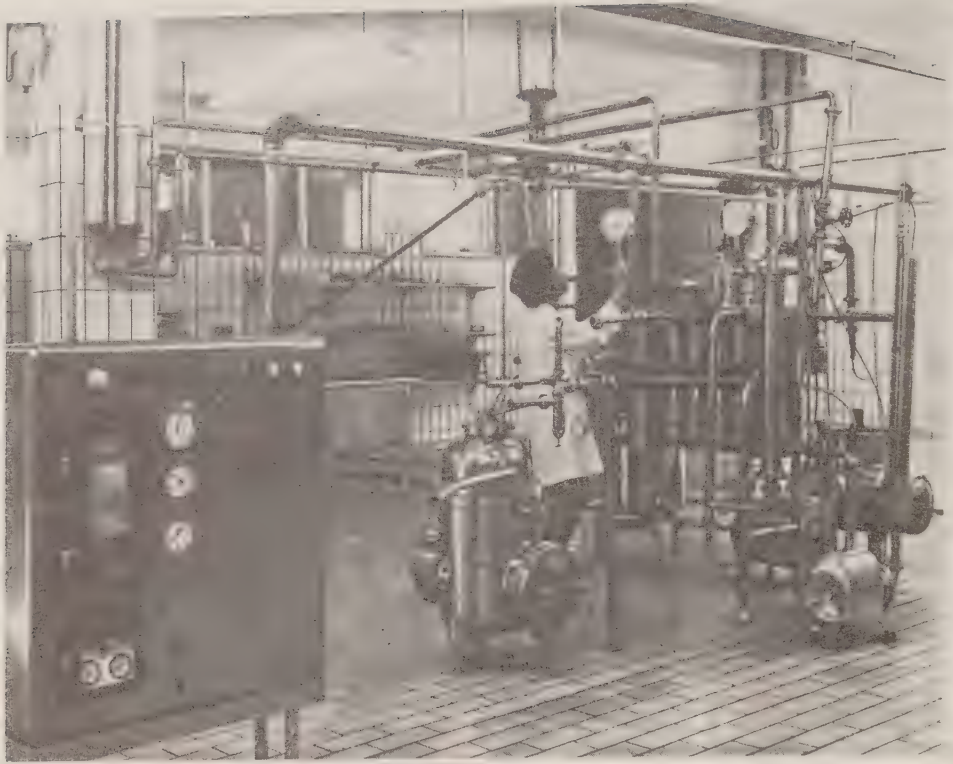
Milk

The efficiency of the infra-red pasteurisation of milk — The efficiency of the infra-red pasteurisation of milk was compared with that of the conventional, steam-heated plate pasteuriser, using total counts, coli count, methylene blue reduction time after 18 hours incubation at 18° and residual phosphatase as criteria.

No significant differences were found between the efficiency of the two types of pasteurisers and their effect on flavour and creamline were found to be similar. It was concluded that the infra-red type of pasteuriser could be accepted by local health authorities, provided that certain modifications are made to the safety devices to ensure that no unpasteurised milk leaves the plant.

This type of pasteuriser can fill a definite need in small dairies in South Africa as it is compact, easily installed and operated and does not require costly steam and refrigeration installations.

Nitrate reduction time for estimating the bacterial content of milk — The purpose of this study was to investigate the role which the coliforms, psychrotrophs and thermotolerant organisms play in the reduction of nitrate and whether this criterion can be recommended as an index of the hygienic quality of milk.



The unit used for cleaning, pasteurising and standardising milk in the test factory of the Dairy Science Section at the Animal and Dairy Science Research Institute



By means of this automatic milk tester at the Animal and Dairy Science Research Institute 180 samples can be tested per hour for fat and proteins

On the average the reduction time was shorter for refrigerated milk than for can-collected milk with a given count. When the reduction time was determined after pre-incubation the relative importance of the initial number of coliforms increased while that of the psychrotrophs decreased and the thermotolerants became relatively insignificant.

Sampling of milk for butterfat determination — The possibility of replacing the present butterfat sampling and testing method (sampling daily and tested as 10-day composites by the Gerber method) by another method was investigated.

Under certain conditions and when the samples were properly taken, preserved and handled, it may well be possible to test 15-day composites and to keep the samples for another week for a check test by an inspector.

Quality of industrial milk — A survey conducted at a large cheese factory during February and March proved that a methylene blue reduction time of 90 minutes will be an indication of acceptable quality in industrial milk. The results have shown that 70 percent of the samples had reduction times of 90 minutes or less which means more than 13 million bacteria per ml.

Keeping quality of fruit-milk drinks — The keeping quality of milk which was flavoured by the addition of different fruit juices and stabilised to prevent coagulation was determined and found similar to that of pasteurised milk (2-3 days at 15°C).

Cheese

Cheese starter programme — The local cheese industry still has to import its commercial starter cultures. It is, therefore, intended that the Institute should constitute and produce cheese starters.

The selection of specific cultures will have to be accompanied by a thorough study of their taxonomic and physiological properties in order to constitute the most suitable culture. A number of projects is involved.

Certain commercial cheese starters were thoroughly examined to learn more about their properties, composition and activity.

Isolations and identifications from 13 commercial starters were carried out. Almost 400 isolates were made and it was found that the greatest percentage of these are *Streptococcus cremoris* and *S. diacetylactis*.

It was also established that there is little difference in activity between the starters grown at 25°C and those grown at 22°C. The total count does, however, tend to be slightly higher at 25°C.

Methylene blue activity tests were carried out on certain isolates from the starters examined. It was found that the repeated transfer of these isolates to milk did not increase the activity of all the isolates. In certain cases the activity even dropped.

Composition of cheese starters for the preparation of South African Gouda cheese — Six cheese starters were constituted by choosing certain isolates from the groups on which the methylene tests were carried out. It was established by means of acid titrations that the activity of these starters remained virtually constant. They are used to manufacture Gouda cheese. Excellent results were achieved with one of these starter cultures, and a second also gave good results. Certain isolates from the starters investigated were also chosen for use as single-strain cultures in the manufacture of Gouda cheese.

Rind defects in Gouda cheese — Difficulties with cracks in the rinds of Gouda cheese are often experienced and it was found that pieces of curd joined to make a cheese very often resulted in cracks at the joints if the curd had cooled down before joining. It is now recommended that curd blocks be cut as accurately as possible to minimise the number of joined-curd cheeses and that incorrect sized pieces of curd should not be allowed to accumulate until the end of the mould filling operation.

Shrinkage, appearance and wax adhesion of Gouda cheese — The appearance of Gouda cheese on the South African market often leaves much to be desired. In a study it was found that two applications of polyvinylacetate at three and eleven days after brining, followed by waxing at 14 days, gave the most acceptable results as far as appearance and wax adhesion was concerned. This treatment, however, resulted in an increase of 1.5 per cent in shrinkage when compared with standard treatments, but made it possible to cure at higher relative humidities without serious mould problems.

If, therefore, it is possible to increase the relative humidity by approximately 10 per cent the increased shrinkage could be eliminated and satisfactory appearance be obtained at no extra costs.

The pH of the brine had no significant influence on appearance, shrinkage or wax adhesion over the range tested.

Flavour development in cheese made from skim milk and vegetable fat — Cheese making experiments were carried out, using milk in which the butterfat had been replaced by a vegetable fat. The results proved that it was possible to make cheese with a satisfactory quality from skim milk and vegetable fat. This cheese did not,

however, develop a typical cheese flavour. When the butterfat was only partly replaced the intensity of the cheese flavour increased and when vegetable fat containing short-chain fatty acids (coconut oil) was added to this milk, a pronounced flavour developed, resembling goat's milk cheese.

The results suggest that most of the substances responsible for the cheese flavour are formed during the ripening process from triglycerides containing short-chain fatty acids.

A study of the microflora of South African Gouda cheese up to selling age — The composition, development and effect of the microflora in Gouda cheese, and the possible relationship between these bacteria and ripening and certain defects were investigated. Microbiological, chemical and organoleptic investigations of 26 cheese samples from 20 cheese factories were carried out when the cheeses were one, four, six and eight weeks old.

In view of the conditions under which Gouda cheese is produced, and the quality of milk received, the microbiological and organoleptic findings indicate fairly acceptable quality. There is room for improvement, however, chiefly with regard to the coagulase-positive *staphylococci*, although in most cases numbers were below the acceptable count of 500 000 per gramme.

Recommendations based on this study can be made to factories. The study also revealed defects that justify further research on specific subjects.

The salting of Gouda cheese in brines — A number of experiments was done on the acidification of brine. It was found that a high degree of acidity (pH = 5,0) caused slightly greater loss of weight. However, the effect of osmotic pressure, particularly in old brines, should also be taken into account here. Acidified brine ensures that rind formation will be good and the bacterial content will be kept low. Brine with a pH of 4,9 to 5,0 is recommended for factories.

Butter

Investigation of oxidative taste development in butter — The development of fat defects in butter is ascribed to the oxidation of the unsaturated fatty acids and the consequent formation of carbonyl compounds, some of which lead to the typical oxidation defects in butter. Testing to determine the deterioration of butter at an early stage was carried out and the test butter was compared with butter kept at normal storage temperatures.

The findings show that the acid value together with the carbonyl value will give a good indication of the degree of oxidation and the oxidation capacity of butterfat.

Judging the quality of butter by means of bacteriological analysis — Four bacteriological count procedures were subjected to evaluation during this study. With regard to prediction of the keeping quality of the butter four different tests were decided upon.

The moisture distribution in the butter was well correlated with the growth of the bacterial groups in butter. The salt-in-serum content of the butter, i.e. the salt content expressed as percentage of the moisture content, had a significant effect in suppressing the growth of bacteria in the butter. The salt-in-serum content also had a significant effect on grading after 5 months at -10°C. According to this a higher salt content gives a better grading figure after 5 months than butter with a lower salt content.

Objective quality judging and the determination of the keeping quality of butter — Samples were collected periodically from five creameries and stored at 20°C (for the rapid keeping quality test) and at -10°C (ordinary commercial storage temperature). The samples were analysed at regular intervals for a period of six months for moisture distribution, moisture content, salt content, pH, total saturated and unsaturated carbonyls, peroxide value, acid value, contaminating organisms, lipolytic and proteolytic bacteria, yeasts and moulds.

The separate and collective contributions of these quality characteristics to decline in quality could be determined by carrying out analysis directly after churning and after one week of storage at 20°C. It was clear that these quality characteristics each made a greater or lesser contribution to the decline in quality during storage.

These characteristics are responsible for 55 per cent of the total decline in quality, but 45 per cent must be ascribed to subjective or organoleptic criteria. In the case of the keeping quality the figures were 64 and 36 per cent respectively.

By-products and other dairy products

The ultra-filtration and inverse osmosis programme — The concentration of the solids in milk and milk products, and the separation of certain milk constituents by means of inverse osmosis and/or ultra-filtration, are new developments in the dairy industry. Their advantage is that heat treatment and separation by chemical means are eliminated, and this ensures that no changes in the milk constituents take place. These processes may also have economic advantages.

The first stage of this programme at the Animal and Dairy Science Research Institute includes studies on various techniques, including the following:

The concentration and fractionating of milk constituents — It was found possible to concentrate skim milk to a solids content of up to 40 per cent. It was found that the milk had to be pumped evenly through the apparatus. A piston pump is not suitable, because it damages the membranes. The use of proteolytic enzymes was not very successful, but is undergoing further investigation.

The loss of good nutrients in whey is considerable, but it was found that it was possible to concentrate whey to a solids content of over 15 per cent, two thirds of which is lactose.

The application of the concentrate (retentate) from skim milk — The production of both cheese and a spreadable product that keeps for at least 14 days was undertaken. With its low fat content the product obtained is palatable and may be used in many dishes.

The quality improvement service

A quality improvement service for butter was started with the object of ensuring greater uniformity in quality.

During previous investigations, and after a testing period of six months at five different creameries, it was found that quality may be divided into three classes in which each property carries a certain weight (multiplication factor) that corresponds to its particular contribution to quality.

In the performance of this service 271 samples of choice butter from 20 creameries were examined. The results indicate that the control of moisture distribution, percentage moisture, pH and salt has already improved considerably. The poor carbonyl and acid values found indicate that oxidation of the butterfat still occurs. Most butter had a high count of contaminating organisms and creameries with wooden churns again had high yeast and mould counts.

Under the present grading system 81 per cent of the butter is classified as choice grade, but under this system of objective quality judgement only 40 per cent would comply with the requirements for choice grade. As far as keeping quality goes, only 20 per cent of the butter would still be graded as choice after a storage period of five months at -10°C. These results show that there is a great deal of room for improvement.

Extension and training

Officers from the dairy section of the Animal and Dairy Science Research Institute gave extension in

various areas and served on committees to advise persons in the dairy industry. The following are some of the chief services performed in this connection:

The section concerned with dairy product improvement services followed up butter analyses in order to improve the quality of butter. Moisture distribution and pH, the two factors that have a great effect on keeping quality, are at present carefully controlled by several factories.

Assistance was given to various factories where cheese starter problems had been encountered. At one factory the problem of coagulation of sweet, skimmed condensed milk was investigated and recommendations aimed at preventing this problem are now being implemented.

Dairy scientists from the Animal and Dairy Science Research Institute are involved in all the chief agricultural shows where dairy products are judged.

Officers assist in designing factories and in erecting apparatus and make general recommendations on the purchasing of apparatus and factory equipment.

The extension section of the Institute is continuing to give advice, demonstrations and instruction on chemical and bacteriological analyses; these analyses are also undertaken for factories and producers.

Five different courses — on dairying, cream testing, cream grading, milk tests and the making of Gouda cheese — were offered by the dairy section at Glen and attended by a large number of students.

Feeding

Rearing Friesland heifers at various nutritional levels — In the second phase of the feeding trial at Elsenburg the growth and fertility of heifers fed on silage and a limited quantity of concentrates (without grazing), are being compared with those of a group of heifers that had free access to a mixture consisting of lucerne hay and oat hay plus a mineral protein lick in a kraal system (without grazing). The heifers grew better on hay plus the lick and so far they have reached the covering mass 37 days earlier on the average and calved 47 days earlier than the other group.

After the first calving the heifers in the hay-plus-lick group were 38 kg heavier on the average than the other heifers and their average mass was only 7 kg less than that of the heifers fed at a high level, which included a high percentage of concentrates, during a previous stage of the project.

Rearing calves on skim milk plus skim milk balancer — In a trial at Elsenburg in which two levels of

skim milk, viz 7 per cent and 14 per cent of body mass a day up to a maximum of 9 litres a day, and two methods of feeding, viz artificial teat feeding and bucket feeding, are being compared, no significant differences in growth increases in Friesland calves were found.

The results show that under these conditions there are no advantages in giving calves milk by means of an artificial teat instead of in a bucket and that the lower level of skim milk provides enough protein to supplement the protein in the low-protein mash used.

Since the calves are weaned from whole milk at the early age of four weeks and the mash is relatively cheap because of its low protein content, this system of rearing can mean a great saving in costs.

Jersey calves, unlike Friesland calves, did better on the higher level of skim milk than on the low level.

Vitamin A and B carotene status of herd replacement heifers at Elsenburg — Since there has been some concern about the supply of vitamin A to dairy cattle in the Winter Rainfall Region and the use of silage in intensive feeding kraal systems has come under suspicion, a survey on the blood vitamin A and blood carotene status of two groups of heifers was carried out at Elsenburg: one group is reared exclusively on silage plus limited amounts of concentrates (without grazing) and the other on a hay mixture plus lick (without grazing).

In both groups of heifers the average blood vitamin A and blood carotene values over a period of six months were satisfactory. The silage does in fact provide more carotene than the hay mixture half of which consisted of lucerne hay and the other half of oat hay.

In the same trials it became clear that calves that were growing rapidly and were weaned at four weeks and then reared on calf starter mash containing 10 per cent of lucerne meal did have a significantly higher vitamin A status and grew better than similar calves reared on the same starter mash, with 10 per cent of oat hay meal instead of lucerne meal.

Complete diets for dairy cows — There has been increasing interest in the use of complete diets, which may be mixed by feed firms and delivered in bulk and may serve as the only ration for cows kept on small properties in kraal systems.

At Welgevallen in the Winter Rainfall Region trials were carried out in which a conventional ration consisting of hay, silage and concentrates fed according to production was compared with two unconventional rations fed *ad lib*. In one ration the hay and concentrates were pre-mixed in the ratio of 30:70 and in the other case the cows had free access to ground hay and concentrates in separate feeding troughs.

There were no significant differences in milk production between the first two groups of cows, but the third group, i.e. the one fed the "free choice" ration, which took in more feed, produced 10 per cent more milk. No significant differences in protein and butterfat production could be established. As far as the efficiency of energy conversion goes, the group of cows kept on the conventional ration did best.

The use of complete diets is probably a more expensive feeding system, except where labour is very dear or where the management and handling of exceptionally large herds milked in walk-through milking parlours make it profitable.

Research in the Eastern Cape on the development of complete silage rations for dairy cows showed that a 40:60 concentrate:silage mash (on the dry basis) gave better results than the 50:50 or 30:70 mashes. Trials where *Eragrostis curvula* was used in complete diets for dairy cows showed that there are major drawbacks. Homogeneous concentrate-roughage mashes are not available and animals are still inclined to eat selectively. In addition, finely ground *Eragrostis curvula* irritates the mucous membranes and the feed intake tends to be below normal.

During the winter of 1971 a grazing trial was conducted at Cedara to establish the grazing and economic value of rye-grass as a winter feed:

Treatment 1: Cows received silage and hay and concentrates at the rate of 0,4 kg per litre of milk produced in excess of 6,7 litres.

Treatment 2: Cows received rye-grass grazing for 5 hours per day and hay. Concentrates were fed at a rate of 0,4 kg per litre of milk produced in excess of 11,2 litres.

Treatment 3: As for treatment 2, but concentrates were fed at 0,4 kg per litre of milk produced in excess of 6,7 litres.

The trial showed that there was no difference in milk production between the groups grazing rye-grass. The extra concentrate fed to the cows in treatment 3 was, in fact, wasted.

The results showed that both rye-grass groups were economically superior to the silage/hay group and that a considerable saving in cost could be made by judicious feeding of the concentrate.

There was no significant change in live mass of the cows during the trial, nor was there any significant change in milk quality as far as solids-not-fat and butterfat percentage are concerned.

From the milk production obtained and the intake figures, the actual feed value of the rye-grass was calculated at:

total digestible nutrients 66,4 per cent and 15,8 per cent digestible crude protein.

One of the most prolific summer growing pastures in the Natal midlands is kikuyu *Pennisetum clandestinum*. This grass is used fairly extensively. However, milk production from kikuyu very seldom measures up to its potential as determined by chemical analysis. A grazing trial was, therefore, designed in order to determine more specifically the nature of the problem.

The trial consisted of three groups of cattle with 10 cows in each group.

Treatment for group 1 — Kikuyu grazing supplemented with a 13 per cent crude protein ration.

Treatment for group 2 — Kikuyu grazing supplemented with maize meal.

Treatment for group 3 — Kikuyu grazing supplemented with a 13 per cent crude protein ration and also *Eragrostis curvula* hay fed *ad lib*.

Any advantage of feeding extra energy should be shown up in improved milk production in group 2, whereas any advantage from increasing the available dry matter should be shown up in milk production for group 3.

The preliminary results of this trial revealed that certain trends were fairly clear:

- There was no advantage in feeding a more expensive protein concentrate ration. Milk production from maize meal alone was at the same level, showing that only total digestible nutrients needed supplementation.
- There was no advantage in feeding hay in the early part of the season. But an increase in level of production became evident in cows receiving hay from February on.
- Dry matter intake appeared to be adequate, being about 3 per cent of the live mass of the cows.

At the Uitkomst Research Station in South West Africa the project aimed at establishing whether milk production on a more intensive scale would be profitable was continued. The latest results again show that the Frieslands in the group fed at the high level produced

more than the Brown Swiss cows. However, in the group where the feeding level was low the opposite results were obtained, which is an indication of the better adaptability of the Brown Swiss.

SHEEP AND WOOL

Production trends

The low wool prices and the Stock Reduction Scheme were responsible for a great change in the Merino sheep industry in the Karoo Region. Besides achieving its primary aim, namely veld improvement, the Scheme is also bringing about an improvement in the quality of Merino flocks. The sheep that have been retained, are subjected to strict selection for high production, good quality wool and also reproduction.

The good grazing conditions since the second half of the year under review, together with smaller numbers of stock (but of better quality), must inevitably lead to higher production per unit of small stock. The lambing percentage also rose appreciably.

In view of the marked rise in meat prices and low wool prices a fairly general change-over to mutton-wool sheep was inevitable. Culled Merino ewes which were previously sold as slaughter animals are now used on a large scale for the production of slaughter lambs.

The average prices for wool towards the end of the season were 62,5 per cent higher than the opening prices. The increase in the average price compared with the previous season now stands at 18,5 per cent. This large-scale improvement has given farmers a new confidence in their product and a general spirit of optimism prevails.

The good rains of the season, the rising wool prices and the high prices for mutton brought about a definite revival of the sheep industry in the Eastern Cape. As a result of a sharp swing to breeding on a larger scale the composition of flocks is rapidly changing and ewes are replacing wethers on a large scale. More and more slaughter animals are finished in sophisticated systems and at an earlier stage.

Sheep numbers in the Free State Region declined considerably, and on some farms the Stock Reduction Scheme has led to sheep farming being stopped altogether. But the decline in sheep numbers resulted in an improvement in the quality of the remaining sheep. Furthermore, ewe farming is on the increase at the expense of wether farming.

The result of stricter selection and better grazing conditions is that a higher income is obtained per sheep unit.

A marked intensification of the sheep industry is taking place in the Transvaal Region. Farmers are dispensing with specific lambing and breeding seasons, and efforts are being made to obtain as many lambs per year as possible. But injudicious veld management practices are slowing down this trend.

The year under review will be known as a period of unprecedented prosperity in the Karakul industry. For the first time in history average pelt prices rose to more than R10 a pelt. The highest average price was R10,64 per pelt.

There is an ever increasing interest in breeding for coloured Karakul pelts, so that at present the demand for white and brown Karakul rams cannot be met.

The total production figure for 1971/72 is put at 5 647 734 pelts which realised R50 263 832.

During the 1971 calendar year, the Republic's contribution amounted to 36,3 per cent of the total SWAKARA production. This indicates that while the production in South West Africa remained more or less constant the Republic was to a large extent responsible for the 4,6 per cent increase from 1970 to 1971.

In the western parts of the Free State Region, great interest developed in Karakul sheep because of the high prices obtained for Karakul pelts. As a result of this, and the implementation of the Stock Reduction Scheme, there was a considerable decline in the numbers of Dorper and Dorper-type sheep kept for meat production.

Mutton-sheep performance and progeny testing scheme

37 farmers are now participating in this scheme which continues to make fairly steady progress. During the year under review, data has been received chiefly from Dorper but also from Dormer, South African Mutton Merino and Dohne Merino breeders. The data of 4 377 lambs has been processed.

Officers working on the scheme assisted in the selection of 25 597 sheep during 1971-72 compared with 15 564 in the previous year.

Performance testing of woolled sheep

In developing performance tests for woolled sheep, the Animal and Dairy Science Research Institute encountered many problems in the first few years. These difficulties were solved in due course so that performance testing of woolled sheep is now firmly established. Approximately 12 000 wool samples are now analysed annually, but indications are that a much larger number of samples will be analysed in the future.

Performance measurement of the characteristics of a woolled sheep is a fairly new practice in wool farming. In view of the great stress formerly laid on the subjective evaluation of wool characteristics, especially in training farmers in sheep and wool science, it is understandable that wool farmers and officers will not immediately appreciate the value of objective measurement.

The imparting of knowledge about performance testing of woolled sheep, based on performance measurements, and about the advantages of these tests, is an important function of the South African Fleece Testing Centre. A great deal of research had shown that this knowledge can only be imparted to farmers effectively through the type of lectures and demonstrations offered in day and week courses. The method of presentation has also gradually been refined, particularly by means of audio-visual aids.

A number of breeders have already joined the Performance Testing Scheme for woolled sheep. Meetings of these breeders in the form of symposiums are also planned to enable them to exchange ideas, and in this way to increase the effectiveness of performance testing.

Other steps to promote wool production

To ensure the production of good quality wool, research in the Karoo Region has concentrated on factors which have a detrimental effect on quality and on means to eliminate these factors. It has been established *inter alia* that excessive weathering may cause a 30 per cent loss in wool fibre length.

A comparison of wools grown during different seasons showed marked differences in the degree of weathering. The effect of the seasons on the degree of weathering, especially deeper damage, may be mitigated to a large extent by ensuring that sheep are not covered with long wool during the hot summer months.

The South African Wool Board's Field Services, which have been taken over by the Department, are being continued unchanged. During the year under review all applications for wool schools and other services were dealt with.

Research in the Eastern Cape Region in respect of the influence of feeding deficiencies on wool fibres during the year clearly indicates that a medium to overstrong wool is developed from October to February. The fibre thickness also declines much more sharply in autumn than in winter. This extreme fluctuation in fibre thickness is detrimental to wool quality.

The long-term selection trials on sheep at the Grootfontein Agricultural College, the Carnarvon Experimental Farm and in the Tarka Soil Conservation



A white-wool mutton breed is being developed at the Carnarvon Research Station. This photograph shows a group of two-tooth rams, the first progeny of various crosses

Area are progressing satisfactorily. With the development of a new white-woolled mutton breed for extensive farming areas the last part of the basic crossing programme was completed during the year under review. Attention will be given in the future to selection for growth and reproductiveness within and among the groups to be crossed.

The influence of raised temperatures on the genital organs of rams — High temperatures have an effect on the male reproductive system. Karakul rams were subjected to high environmental temperatures before, during and after puberty to establish to what degree

these temperatures would affect the reproductive system. Preliminary results have shown that environmental temperatures as high as 43°C for about 6 hours per day have no significant effect on puberty and production of semen in sheep.

The induction of parturition in the Karakul ewe — To follow up previous findings with flumethazone the experiment was repeated with dexamethazone. Results show that the latter was not as effective for the above-mentioned purpose as flumethazone. Various hormone determinations were done on samples which were collected during this experiment.



Students at the Grootfontein Agricultural College doing practical wool work

Lactation-anoestrus in the ewe — An experiment was carried out with twenty South African Mutton Merino ewes (breeding season begins in October/November) and twenty crossbred Mutton Merino X Border Leicester ewes (breeding season begins in February). The ewes lambed during the second half of October.

The conclusion arrived at was that if ewes received adequate feeding and suckling was limited to a maximum of three months, lactation-anoestrus was of no practical importance. The influence of the lambing season in relation to the breeding season is probably of much more importance. As regards the breeding of Karakul sheep in the Free State Region, breeders now chiefly concentrate on the sought-after pelts of the SWAKARA shallow curl type. According to auction sales reports of 1971, about 65 per cent of the total number of pelts marketed were of this type.

There is a growing realisation of the importance of colour variation in the Karakul industry. The lead has been taken at the Kalahari and Gellap'Ost Research Stations with regard to the breeding of white and grey sheep. It is clearly very important at this stage to maintain improvement in the pipe curl types. With this

object in view, the small number of pipe curl types at the research stations will shortly be brought together at Neudam.

Efforts are still being made to raise the production rate and fertility of the Karakul sheep. Hormone swabs can be used effectively to synchronise the oestrous cycle in ewes. The results of different projects are now beginning to throw light on problems that existed in the past, such as the duration of the swabbing periods, the dose of PMS (pregnant-mare serum) which would produce mainly twins in the period of PMS administration.

It is evident, up to now, that the use of PMS within the breeding season produces better results with smaller doses which are applied two days before the withdrawal of the swabs. The longer swabbing period (15 days) did not only improve the conception, but also resulted in a higher total lambing percentage.

The long-term results of hormone treatment indicate that swabs plus PMS out of breeding seasons followed by normal mating without treatment in the breeding seasons, should produce better results than two hormone treatments a year. The primary phase of a



Grootfontein diploma students in their new lecture hall

project where the effect of weaning age (coupled with creep feeding) was investigated, indicated that the weaning age in itself had no significant effect on the growth and puberty of autumn-born lambs. The autumn-born lambs were inclined to reach puberty only during the following breeding season (10–12 months of age). The ewes from the different groups showed no difference in conception when subsequently mated.

The first positive results with an earlier dual mating season with flushing led to a total lambing percentage of 181 per cent as against 163 per cent from the uninterrupted mating group.

Feeding

The Animal and Dairy Science Research Institute has carried out the first stage of a project to determine the reasons for differences in production efficiency between animals. This study was carried out with sheep.

It appears that the differences in the body composition and feed intake of animals are largely responsible for the difference in production efficiency. A third factor is the genetic capacity of an animal to use nutrients for specific useful functions of production. This genetic capacity differs considerably in different types and offers great possibilities for selection. Knowledge of this factor is of great value in establishing

more effective standards in selection programmes. It has also been established that the tolerance of certain indigenous types of stock for unfavourable feeding conditions is closely connected with a high percentage of fat in body mass increase. This hardness does not go with a high production capacity under favourable conditions.

The Department's first open track, gas exchange apparatus is rapidly nearing completion. It will then be possible for the first time in South Africa to determine the net energy value of feed for sheep, goats, calves and pigs without having to slaughter the animals. The large variety of ruminants in South Africa (various indigenous stock types as well as a great number of wild species) makes it possible for researchers in South Africa to make a unique contribution to the world's store of knowledge regarding the differences between ruminants in production capacity and efficiency. With this object in view animals such as the indigenous fat-tailed sheep and blesbuck are used to advantage in the research programme of the Animal and Dairy Science Research Institute, to test the efficiency of fodder consumption in farm animals.

An experiment is now being carried out to find practical methods to make the potential energy of frostbitten grass available for animal nutrition. It is already possible, in the laboratory, to surmount the

suppressive effect of the lignification process on the nutritive value of grass. An attempt is now being made to find practical ways of converting the tremendous quantities of dry grass, burnt as useless every year into useful animal products.

Results of experiments with large numbers of sheep indicate that the use of radio-active tritium holds out great possibilities for ascertaining the body composition of the living animal. This is a very simple technique and can be applied rapidly and at a low cost.

The evaluation of the change in the body composition of animals in various experiments is a reliable criterion in nutrition study.

In the Karoo Region seasonal and protracted droughts present the greatest problem as regards feeding. For this reason feeding research is mainly focussed on drought feeding.

The information obtained from this research has given satisfactory results when applied in practice. For instance, it was found that the protein content of natural grazing in most of this Region during a seasonal drought is not the limiting factor in the case of dry sheep, and that energy and phosphate supplementation can accelerate the increase in body mass.

The problems engendered by droughts can, to a large extent, be alleviated or solved by the utilisation of drought-resisting crops, the supplementary feeding of suitable rations and the fattening of old surplus sheep.

A survey showed that about half the sheep farmers in the Natal Region did not mate their young Merino ewes until the four-tooth stage or later. Investigation at the Kokstad Research Station showed that a large percentage of the ewe flock did not reach the required mating mass at 18 months of age owing to the poor growth of autumn-born Merino lambs during their first summer on the veld.

In a preliminary trial seven of the fourteen lambs reached a mating mass of 36 kg at 18 months of age. Ninety-five per cent of this mass was gained on grown feeds and only 5 per cent off the veld.

Experiments were initiated to try to boost the growth of these weaned lambs on the summer veld. Molasses supplementation gave an increased final mass at the end of the grazing season 1,6 kg better than the veld control group, a protein supplement yielded 1,9 kg and a protein and meal supplement yielded 5,4 kg better than the veld control. Similar ewes on an irrigated pasture produced a mass gain 11,1 kg better than the veld control group, illustrating the potential of Merino lambs to grow when given the right conditions.

Oesophageally fistulated sheep were used at the Kokstad Research Station to sample summer veld. The crude protein of veld samples taken from the fistulated lambs averaged about 8 per cent over the grazing season while grid samples of the veld averaged 5,5 per cent crude protein. These fistulated lambs kept on veld over the winter yielded samples giving crude protein percentages of 6,5 per cent in May to 5 per cent crude protein in early August.

During the same period the grid veld samples yielded 3,4 per cent crude protein in May down to 2,5 per cent crude protein in early August. This illustrates the ability of lambs to select for crude protein, but at the expense of body mass which dropped from 36 kg in May to 27 kg in early August.

Research on the intensification of sheepfarming still enjoys high priority in the Department of Sheep and Wool Technology at the University of Pretoria. A great deal of attention is given to increasing reproductive efficiency and the concomitant problems. The first stage of the investigation into the handrearing of lambs has been carried out successfully. It was evident from this that lambs which grew up on milk substitutes thrived just as well as those which were suckled.

The economics of this practice are being investigated in a project in an attempt to cut down expenses so that it will be more acceptable to the farmer.

In the Free State Region the hybrid sorghum Trudan II offered outstanding grazing for sheep during the past summer. Pasture which was utilised for the first time in the 45 cm stage and the regrowth of which was repeatedly cropped supplied more than 7 000 days' sheep-grazing on green fodder without a single case of prussic acid poisoning occurring.

The same sorghum yielded very good results when it was grazed for the first time in the soft doughy kernel stage. The sheep made good use of the pasture but a considerable quantity of residue in the form of hard stalks remained behind. Nevertheless, the regrowth of this pasture was good.

The influence on wool growth of urea, fishmeal and methionin as supplements to a low protein ration was investigated in the Winter Rainfall Region. In comparison with urea, methionin and fishmeal pushed up wool production by 11 and 30 per cent respectively. The highest wool production, however, was obtained with the supplementation of both methionin and fishmeal.

The influence of formaldehyde treatment, dry heat and steam heat on the digestibility of six different protein sources was also investigated. It was noted that

there was a diminution in the rumen digestibility of all the sources of protein which was in direct relation to the amount of proteinbound formaldehyde. Both the heat treatments also resulted in a significant reduction in the rumen digestibility. It was noted that there was considerable variation in protein sources as regards the degree of the reduction in rumen digestibility.

All these treatments also had a suppressive effect on the hydrolysis of proteins in pepsin. This affect was minimal in the case of steam-heat treated lupin seed and maximal in that of formaldehyde-treated fishmeal.

This research was followed up with a study of the utilisation of formaldehyde- and heat-treated protein sources in terms of tissue and wool growth. The results show that there is an important interaction between the energy level, the protein source and the method of treatment.

Lupin seed-meal and fishmeal were compared with each other as protein sources in the rations of lactating ewes. Over a lactation period of 13 weeks it was found that ewes on lupin seed rations yielded 18 per cent more milk than those on fishmeal rations. The total production of butterfat however was 4,6 per cent higher on fishmeal rations.

With regard to the occurrence of jaundice (enzootic icterus) the selenium level of the main plant species in the western mountain Karoo in the Fraserburg district was investigated. It was evident that jaundice could definitely not be ascribed to selenium poisoning. An examination of the chemical composition of the most important veld plants in the south-central sector of the Great Escarpment (from Aberdeen to Somerset East) revealed that there was a deficiency of certain elements in some veld types. Most grasses contain little crude protein, phosphorous and sodium when dry and are extremely fibrous.

Then again most veld plants in the higher-lying parts also contain little molybdenum and the supplementation of copper-containing licks can lead to copper poisoning. A large number of bushes and shrubs which are regarded as being unpalatable contain a large quantity of ether-extractable material, which confirms the supposition that there is a connection between the ether extract content of a bush and its palatability. The ether extract content may to a very large extent determine the palatability of a veld plant — the higher the ether extract content the less palatable the plant.

In an experiment at the Langgewens Research Station, the early weaning of lambs (lambs weaned at about 20 kg) is being compared with the conventional practice of weaning lambs only at 4½ months — a practice which is applied in the cropping regions of the Western Cape. A third group of ewes is being used in this

experiment to examine the feasibility of having three lambing seasons in two years. Immediately after the early weaning of lambs the ewes are synchronized with teasers and then covered.

The ewes which were subjected to high reproduction demands produced 0,6 kg less wool during the year under review than the other two groups.

The envisaged three lamb crops in two years are not achieved, but four lamb crops are obtained in three years. This is possibly due to the fact that lambs were weaned at a minimum mass of 20 kg and not at a minimum age of 60 days. During the year under review all three groups of ewes lambed in the same season. No difference was noted in the breeding performance of the three groups. Hardly any difference was noted in the growth rates, age at slaughtering mass (roughly 32 kg) and slaughter yields from lambs.

In another project in the Winter Rainfall Region where weaned Merino lambs were subjected to various feeding treatments in order to reach a mass of 37 kg in 6 months the influence of these treatments on their production and reproduction was investigated. The most important result so far is that wethers which reached the above mass in 6 months were already marketable with a carcass mass of 18 kg and were graded as super and first grade. In practice this means that the Merino farmer can dispose of a large part of his lamb crop before the dry summer.

The young ewes were mated at 9 months (in March) and 70 per cent of them lambed at 19 months of age during the peak feeding period. Their lambs were weaned at 3 months to prepare them for the normal mating season commencing at the beginning of January.

This proves again that if the farmer can see to it that the weaned lambs reach the crucial mass of 37 kg (80 lb) within a specific time they can immediately be brought into the production cycle of his flock.

A survey showed that about half the sheep farmers in the Natal Region did not mate their young Merino ewes until the four-tooth stage or later. Investigation at the Kokstad Research Station showed that a large percentage of the ewe flock did not reach the required mating mass at 18 months of age owing to the poor growth of autumn-born Merino lambs during their first summer on the veld.

In a preliminary trial seven of the fourteen lambs reached a mating mass of 36 kg at 18 months of age. Ninety-five per cent of this mass was gained on grown feeds and only 5 per cent off the veld.

Experiments were initiated to try to boost the growth of these weaned lambs on the summer veld.

Molasses supplementation gave an increased final mass at the end of the grazing season 1,6 kg better than the veld control group, a protein supplement yielded 1,9 kg and a protein and meal supplement yielded 5,4 kg better than the veld control. Similar ewes on an irrigated pasture produced a mass gain 11,1 kg better than the veld control group, illustrating the potential of Merino lambs to grow when given the right conditions.

Oesophageally fistulated sheep were used at the Kokstad Research Station to sample summer veld. The crude protein of veld samples taken from the fistulated lambs averaged about 8 per cent over the grazing season while grid samples of the veld averaged 5,5 per cent crude protein. These fistulated lambs kept on veld over the winter yielded samples giving crude protein percentages at 6,5 per cent in May to 5 per cent crude protein in early August.

During the same period the grid veld samples yielded 3,4 per cent crude protein in May down to 2,5 per cent crude protein in early August. This illustrates the ability of lambs to select for crude protein, but at the expense of body mass which dropped from 36 kg in May to 27 kg in early August.

GOATS AND MOHAIR

Improved grazing conditions resulted in the winter mohair clip (1971) increasing to 2 152 000 kg (13 047 bales), and also led to the production of a somewhat stronger fibre, generally of good length.

The world depression in the textile industry, the monetary uncertainty and high interest rates were largely responsible for the fact that the average price for the winter season dropped still further to 62,2 cents per kg, compared with 91,8 cents per kg for the winter season of 1970. This represents a decrease of 32,2 per cent in 12 months. Kids' hair, in particular, was severely affected by the fall in prices.

The low prices for the winter season together with the Stock Reduction Scheme, were mainly responsible for a slight drop in the summer mohair clip of 1972 (1 842 000 kg, 11 260 bales).

The most significant trend in the Eastern Cape Region was the increase of Boer goats as well as mutton sheep, at the expense of mohair production. This change-over was mainly due to better meat prices and was further stimulated by protracted droughts. It is possible that this trend may now be checked by the marked advance in mohair prices.

In the bushveld area of Uitenhage the Angora lambing percentage just after the protracted droughts was only 54,3, and about one-eighth of the kids died before weaning. This caused an imbalance in the composition of the flocks and only 5,9 per cent were under one year old compared with 53,7 per cent of two years and over.

As a result of improved care and feeding, lambing percentages and the percentage of fine hair have increased. The percentage of kids' hair at the auctions rose from 7½ per cent last year to 14 per cent this year. Angora goats have decreased further in number because of the droughts and losses sustained as a result of the floods in August 1971.

The rising prices of meat and the encouraging results obtained by local research into the practical control of bush encroachment, which is on the increase, have led to an increase in the numbers of commercial Boer goat farmers in this Region during the past year. Great interest has also been shown in milch-goats.

Many farmers do not class their goats annually as is evident from a survey in the bushveld region of Uitenhage where only 73 per cent of farmers strictly class their Angora goats annually. The very low and unprofitable prices during 1971 led to the injudicious crossing of Angora goats with Boer goat rams.

Conditions have now improved to such an extent, however, that the percentage of Angora ewes in the flocks is generally adequate with a fair to good quality goat.

The improved Boer goat has become very popular in the bush-covered and mountainous areas of the Northern Cape and is increasing in numbers. As regards breeding, the Boer goat has made the greatest progress in the Kuruman and Postmasburg areas. Many rams are obtainable at reasonable prices and farmers use them to upgrade their flocks.

The most encouraging factor here is the good price obtained for slaughter-goats. Cattle farmers with a great deal of bush on their farms utilise the Boer goats to feed on and control the scrub.

In South West Africa goat farming is becoming more and more important in the northern parts. The judicious introduction of goats on cattle farms to reclaim the veld is still increasing.

PIGS

Production

South Africa has less than one quarter of the pigs in Africa, but the South African pig industry produces about 45 per cent of the total pork of the continent. There is, therefore, a large potential sales area for pig meat outside the Republic's borders.

At present about 1 300 000 pigs are slaughtered in South Africa every year. The drop in slaughtering during 1970/71 was out of step with the general tendency during the past ten years when the number of slaughterings doubled and the pig population increased by 72 per cent.

During the year under review the consumption of pork was 3,8 kg per capita, an increase of 0,4 kg per capita during the past ten years.

National aid schemes

Members of the Pig Improvement Schemes still have an active interest in these schemes, and there are indications that the enthusiasm of the members will steadily grow according as the activities of this section of the Animal and Dairy Science Research Institute are expanded. Moreover, the present prosperity in the pig industry increases the need on the part of breeders for good and specialised services.

During the year under review more attention could be given to specialised service and extension owing to the fact that methods and programmes for the processing of data have reached a final stage. The backlog of work has been brought up to date, in spite of the shortage of staff, and good progress was made with an advisory service to members of the scheme.

Three reports based on the data collected under the various phases of the pig improvement schemes, which indicate some shortcomings in the pig industry, have been completed. Two of these reports have already been distributed and the third, which deals mainly with progeny testing, is at the printers.

A fourth report, similar to the first two, is nearing completion and parts of it have already been distributed among interested parties. These reports are also put to good use by using them as handbooks in specialised extension to expose shortcomings in the industry, and also as a basis for the selection of breeding animals.

Building operations on one of the three new pig testing centres have started and are progressing well. It is expected that the new centre being built at Irene will be completed by December 1972.

The membership of the pig improvement schemes remained constant during the year. There is a possibility that this number will drop slightly during the coming year as a result of the exclusion of breeders who are members of the scheme only for advertising and show purposes.

Boar performance testing scheme

This section of the pig improvement schemes has received considerable attention during the past few years and this is still expanding. The decentralisation of boar performance testing will, judging by enquiries in this connection, awaken even more interest. This decentralisation provides for the testing of boars at Irene, Cedara and Elsenburg.

The number of requests to have boars tested increased by 78 per cent from 280 in 1970/71 to 499 in the past year. Owing to the lack of facilities only 170 (34 per cent) of these requests could be accepted. The new testing centres should, however, eliminate this problem.

Attempts will be made to establish stricter qualification standards when the new centres have been completed. Unfortunately, quite a number of inferior boars are tested under the present system, and tested boars are also not systematically used for the improvement of pig herds.

There is no compulsory system by which tested boars can be used to the greatest advantage of the pig population. This is one of the biggest shortcomings of the present system, and valuable genetic material is lost. During a recent survey it appeared that a very small percentage of the boars that successfully completed the test were still in the possession of members of the scheme. Some breeders, who regularly have boars tested, themselves no longer own any of the tested boars.

Of the 170 boars received at the centre, only 132 completed the test. Thirty-four were disqualified at an early stage. Twenty-one of these were disqualified on the grounds of trotter and leg defects, nine for hereditary defects and four on account of poor growth capacity. Of the 132 boars that completed the test, 58 per cent were approved for breeding purposes.

In the following table a summary of the average performance of boars that completed the test is given and compared with the figures for the previous year.

province, are now available to participants in the scheme. The fat thicknesses of 1 000 pigs were determined in this way during the past year.

Average performance of boars that completed the test

Characteristic	Performance		Range	
	1971-72	1970-71	1971-72	1970-71
Feed conversion	2,66	2,67	2,10 - 3,42	2,03 - 3,45
Average daily gain (kg)	0,71	0,71	0,54 - 0,90	0,56 - 0,91
C + K fat measurements (mm)	34,4	33,9	29 - 47	25 - 48
Age test started 30 kg (days)	90,4	93,3	61 - 114	- *
Age test ended 91 kg (days)	177,1	179,5	143 - 210	- *

* These figures were not calculated for 1970/71

Progeny testing scheme

Once again there was a drop in the activities of the progeny testing centres. The average percentage of pen use for the three centres was 44 per cent as against 66 per cent the previous year. Only 54 progeny groups completed the test as against 71 the previous year.

This drop can possibly be ascribed to a very high disqualification figure owing to unsatisfactory farrows, the good prices for breeding animals and pig meat, and to the fact that breeders hold back pigs in order to have them tested by the new procedure.

It would appear that the advantages of progeny testing are not yet fully realised and utilised. During the past year only 14 breeders made use of the progeny testing facilities, viz 5 at Cedara, 6 at Elsenburg and 3 at Pretoria. The percentage of pen utilisation at these three centres was 42,4, 44,19 and 44,7 per cent respectively as against 56,6, 71,0 and 66,2 per cent for the preceding year.

Pig recording and health scheme

Slow progress is being made with attempts to make particulars gathered under this phase more reliable. Co-operation among breeders and stricter control by field officers have already brought about a considerable improvement.

In spite of the fact that there was no increase in membership, the number of farrows registered increased by more than 6 per cent. The biggest increase occurred in the Western Cape Region, where 8 per cent more farrows were recorded.

The ultrasonic determination of fat thicknesses was initiated on live pigs in the Free State. Four of these ultrasonic fat meters, of which there is one in each

From the processed data it appears that management ought to be improved on many farms. The average mortality figures of 20 per cent in farrows from birth until three weeks is disquietingly high.

Another aspect that emerged clearly was the high percentage of sows with a term of more than 200 days between farrows, and the detrimental effect of this on productivity. The high percentage of farrows with fewer than six piglets at the age of three weeks and at weaning age also indicates inefficient and uneconomical farming.

Other measures to promote the production of pork

The industry imposed a special levy with an annual target of about R100 000 for the promotion of extension, training and research.

The first organised attempt was to appoint two veterinary surgeons and send them overseas for intensive training in pig diseases and aspects of production. A start was also made with the erection of larger pig testing facilities costing R193 000.

The bacon carcass competition which was begun in 1959 at the initiative of animal scientists of the Stellenbosch-Elsenburg Agricultural College and which is still held under the guidance of an officer of this college, has proved very popular among pig producers and has already made an important contribution to the improvement of the quality of bacon carcasses in the Western Cape. It is a good example of what can be achieved by co-operation between the college, producers and the industry (bacon factories), and serves as a practical demonstration of the advantages of scientific principles of breeding, feeding and management.

Judging at the competition is based exclusively on objective measurements that are taken and compared from year to year to determine progress.

Breeding, feeding and management

The danger of a shortage of fishmeal as protein source in South Africa has stressed the necessity for giving attention to the use of other protein sources as possible substitutes for fishmeal as protein in the ration of non-ruminants. This is why the Pig Research Section of the Animal and Dairy Science Institute is busy planning a project aimed at relieving the pressure on fishmeal as the most important protein source.

The institute has also conducted two trials in order to evaluate a standard pig ration. A complete analysis of the ration and ration constituents was carried out with the aid of chemical analysis and a metabolism trial, while the biological utilisation of the ration was determined by the growth, feed utilisation and carcass composition of pigs in another trial.

Except for a low lysine content observed in the fishmeal, and the amino acid pattern of the wheat bran used, the chemical composition of the ration and ration constituents compares favourably with that obtained by other researchers and also with the accepted standards for a similar ration.

Favourable growth, feed conversion and carcass composition were obtained with baconers to which the standard ration was fed. This information can, therefore, serve as a basis for the determination of feeding standards for pigs in South African conditions.

The quality of pork, i.e. the water-binding property, colour, softness and brine absorption capacity of pig muscles, is to a large extent dependent on the speed with which the degree of acidity increases after death or the pH drops while the carcass temperature is still more than 30°C – i.e. within the first 45 minutes after death. Should the pH value be lower than 6,0 the above-mentioned quality characteristics of the muscles



Determination of the pH value of the muscles in a pig carcass

are very adversely affected and this causes serious losses to the bacon manufacturer, the retail butcher and the seller of consumer cuts in chain stores.

Research at the Institute showed the the method of stunning during the pig slaughtering process may have a profound influence on the pH_1 value. It was established, for instance, that the captive-bolt pistol method leads to extreme muscular contractions and causes a very low pH_1 value, as against electrical stunning that does not affect the pH_1 value to the same extent.

The most significant result obtained in a survey at the bacon factories and three abattoirs is that 71,9 per cent of the carcasses at one abattoir had pH_1 values of 6,0 and lower and could thus be classified as the internationally known pale, soft and watery (PSW) pork. The detrimental effect of the captive-bolt pistol on the quality of meat at this abattoir thus confirms the comparative observations at the Institute.

Among the centres where electrical stunning was being applied, the largest number of PSW carcasses was encountered at one bacon factory. In this case it was established that the delay in the process of gutting found here — as long as two and a half hours after death — was the most important reason for a high percentage of PSW carcasses.

Histological examination of muscle samples of PSW and normal muscles of baconers brought many interesting facts to light. During the rapid drop in pH after death the muscular protein is considerably damaged. The cell membranes of the muscle fibres, which to a considerable degree consist of connective tissue, are damaged to such an extent that they become more permeable to cell fluid. As a result of the movement of cell fluid from the intra- to the intercellular spaces, the muscle fibres shrink.

In this way statistically significant differences in size were found between normal muscle fibres and PSW muscles of baconer carcasses.

Experimental work is being done in the Winter Rainfall Region to synchronise the oestrous cycles of young sows with a view to artificial insemination and to increase the production capacity. Preliminary results indicate that a considerable increase in the number of fetuses can be achieved with PMS (pregnant mare serum) after synchronisation with methallibure.

The advantages of artificial insemination in respect of herd improvement, disease control and crossing are as obvious for pigs as they are for other animals. In trials at present being carried out at Elsenburg, oestrus and ovulation of young sows is being controlled by means of hormones and synthetic hormone preparations to such

an extent that the correct moment for insemination can be determined. Attention is being paid to the technique of artificial insemination with pigs.

FOWLS

Production trends

During the year under review the Egg Production Control Act, 1970 (Act 61 of 1970) started having an effect, although the full results will be noticeable only over a number of years. Owing to the capital needed to utilise the permissible extension, it usually takes 12 to 18 months before production is really influenced.

Owing to the rise in the general cost structure there is a tendency for the turnover to increase, and consequently the units are steadily becoming bigger. Organisations with enough capital show the biggest expansion by taking over private farming concerns.

The efficiency of egg production units is already very high and egg prices are low in comparison with other foods. The rapid rise in the costs of poultry rations, chiefly owing to the higher prices of animal proteins and maize, means that more attention will have to be paid to alternative sources for poultry feed.

There is, however, a healthy increase in production as well as consumption of eggs.

National aid schemes

Eight breeders with 20 entries competed in the random sampling egg-laying test at Glen. This test was completed on 4 February 1972. A hen-housed average of 240,7 eggs with a feed conversion of 2,69 was achieved. This result is the best yet achieved on a local random sampling test and is even better than is achieved in overseas tests.

The tenth random sampling broiler test was concluded on 21 September 1971. Eight pens, each consisting of 120 broilers, competed. At 64 days the chicks reached an average mass of 1,952 kg with a feed conversion of 2,33.

The funds for the erection of facilities for the random sampling egg-laying test at Irene were provided by private fowl farmers and the Egg Control Board. The first test, supported by 22 breeders with 39 pens, was concluded in February 1972. A hen-housed average of 204,05 eggs with a feed conversion of 2,74 was achieved.

Other measures to promote the production of poultry and eggs

The White Plymouth Rock and White Cornish strains which were imported during 1962/63 by the

Department are being kept pure by the Animal and Dairy Science Research Institute for the distribution of fertilised eggs to poultry farmers. A breeding programme with a strong selection pressure is being applied to improve the meat and egg characteristics of these fowls. Turkey toms as well as 420 day-old poult of the two white strains of imported turkeys were sold to the farmers.

On the Institute's farm at Irene a quarantine station was erected for use by private breeders for the importation of broiler breeding material from overseas. A private concern has also erected a quarantine station for the importation of turkey breeding strains on this farm.

The three imported strains of White Leghorns at the Institute are used in a breeding programme to improve economic characteristics. During the year under review surplus cocks and 300 dozen fertilised eggs were sold to farmers. In addition 10 290 dozen hatching eggs were delivered to Onderstepoort for the production of serum against Newcastle disease and rabies.

The development of a table-bird with a sex-linked silver colour has reached a stage in the Natal Region where cross-breeding is now being carried out with a view to comparative studies.

The female progeny, obtained by crossing this silver strain with White Plymouth Rocks, will be a foundation strain for the production of broilers. It can thus be considered an artificial foundation strain for the production of day-old chicks and will be compared with the Plymouth Rock hens, which are generally used for this purpose.

The masses that these chicks have reached by eight weeks (artificial foundation strain) compare very well with the average mass of Plymouth Rocks at the same age. The chicks are now being raised further so as to compare egg production, which is expected to be the most advantageous characteristic, with the egg production of Plymouth Rock mothers.

In the Transvaal Region the genetic environmental and phenotype relationship of egg production with egg mass, body mass and age at sexual maturation of hens have been determined. The influence of the above-mentioned physiological factors on egg production has been determined, and general recommendations have been made concerning the application of the results to farmers' breeding systems. These conclusions are of inestimable value to the poultry farmers.

The importance of the maintenance of pure and inbred poultry breeds is steadily increasing as a result of

the demand for this breeding material for the production of commercial meat and egg-producing strains. For this reason the effect of inbreeding on poultry has been investigated in respect of characteristics like egg production, fertility, body mass, egg mass and hatchability.

Of great importance is the fact that it has been determined that the hatchability of the eggs of the inbred strain has increased tremendously as a result of the provision of additional vitamins. It has been determined that an autosomal recessive gene is responsible for a shortage of riboflavin in the egg and consequent high embryo mortality.

All imported breeding material for broiler breeding, viz the two parent breeds (White Cornish and White Plymouth Rock), three strains of White Leghorns and two strains of white turkeys were included in breeding programmes at the Animal and Dairy Science Research Institute for improved economic characteristics.

A special strain of Rhode Island Red is also being bred to serve as parent strain for a commercial egg producer where the sex of the day-old chick can be determined according to the colour of the down.

Feeding

In a trial on the influence of feed limitation during the growth period on the performance of hens receiving different levels of energy and protein, it was found that the feeding of a ration with a low protein level was more efficient than limiting consumption by providing a complete growth mash every second day.

There were indications that eitriphin had an advantageous effect on the start and duration of the moulting period in conditions of natural length of daylight.

Forced moulting among layers — By withholding water for two days and food for 14 days the hens were made to start moulting. After this the hens were again placed on normal feeding. The first hens again started producing 28 days after the beginning of the withholding.

This work is being continued in order to determine whether it would not be more economical to let hens go through a moulting period after the first year of laying and then to achieve production for a second year rather than replacing the hens with young hens every year.

The feeding of growing broiler breeding hens is being investigated in the Natal Region. A research project on feed limitation of these chickens has been completed. Various protein and energy level treatments

were used to retard mass gain at the age of sexual maturation. Carcass analyses were carried out at three developmental stages for these hens.

Although attempts to control the body mass with feeding were unsuccessful, the fat content of the hens could be controlled. The fat content of the hens was dependent on the intake of energy and was lower among hens that received rations with low energy or high protein. It led to a lower energy intake.

It is generally known that a high fat content in the carcasses of hens has a detrimental effect in terms of production capacity and mortality. Gradually decreasing the protein level of rations during the growth period could, to a certain extent, limit body mass at lower energy levels, while the opposite was observed at higher energy levels.

An important finding of great economic importance for the poultry industry is that higher levels of vitamin A in the feed lessen the intensity of coccidiosis, one of the most important poultry diseases.

Complaints were received from overseas buyers that the yolk colour of South African eggs was unsatisfactory. Research done by the Department of Poultry Science, University of Pretoria, proved that synthetic pigments can be used to improve the yolk colour.

WATERFOWLS

In an experiment at the Cedara College of Agriculture the use of artificial light to stimulate out-of-season egg production in Chinese geese is being investigated. Geese normally lay in spring and this tendency does not allow the goslings to be ready for the Christmas market. If geese could be brought into lay earlier the goslings would reach market age about 16 weeks before Christmas. This experiment showed excellent results in the past year and is being continued for another year.

In another research project methods of reducing the high fat content of ducks by methods of crossing and feeding are tested. The fat content of ducks obtained by crossing with the muscovy was shown to be much lower than that of the pure Pekin.

OSTRICHES

From trials in the Winter Rainfall Region it appears that young ostriches easily take in a mash and show satisfactory mass gains. There is thus a possibility of establishing feeding requirements with greater certainty.

Good progress is being made with the provision of facilities so that ostrich research can be undertaken in a wide field.

HORSES

Nooitgedacht pony

The good progress made with the breeding of the Nooitgedacht pony from the Basuto pony can be seen from the number of daughter studs (19), the number of breeding animals (180) and the fact that a breeders' society was formed in 1969 with the aim of having the breed registered in the Pedigree Register.

The very good temperament, hardiness and average size of the Nooitgedacht pony make this horse a good farm saddlehorse, as well as a popular child's pony. The horse has proved itself at many shows.

Percherons

At Elsenburg the horses in the Percheron stud are used for research into the sexual physiology of the horse and the feeding requirements of young growing horses.

In these trials it became evident that it is quite possible to make up a completely pelleted ration on which foals can be raised successfully from weaning to the age of one year without grazing and on which they grew 12 per cent faster than comparable foals on the same feed but in the usual non-pelleted form.

Over the three years of the trial the average birth masses, weaning masses and one year masses of colts and fillies on pelleted feed were 72 and 66 kg, 355 and 340 kg, and 497 and 485 kg respectively.

The abnormal oestrous cycles of mares early in the breeding season present breeders with a difficult problem. Good results were achieved by using exogenous progesterone in the treatment of the abnormal cycles.

7. Veterinary Services

INTRODUCTION

During the year under review a number of posts in the stock inspection branch of the Division were abolished and transport allocations curtailed. This created great difficulties in maintaining the efficacy of the all-important function of keeping a watchful eye on the stock disease position throughout the Republic at all times, while at the same time controlling serious outbreaks of disease.

Responsibility for the Central Veterinary Investigation Centre at Onderstepoort was transferred from the Division of Veterinary Services to the Research Institute. The Regional Veterinary Investigation Centres were limited to the three at Allerton, Stellenbosch and Middelburg (Cape) in the Republic, and the one at Windhoek in South West Africa.

Outbreaks of sheep scab occurred in one district of the Highveld Region, seven districts in Natal, in the Eastern Transvaal and Winter Rainfall Regions in two districts each, and in three districts in each of the O.F.S. and Transvaal Regions.

Appreciable progress was again made with the bovine tuberculosis eradication scheme. Compared to the 2 084 herds at the end of the previous report year, there are now 2 899 herds participating in the scheme.

The foot and mouth disease position in the Republic remained satisfactory. The infection in game in the Kruger National Park, referred to in the previous report, was still prevalent during the latter half of 1971, but gradually subsided. Any serious extension of infection to the adjacent stock farming areas was prevented by continued intensified patrolling of the game proof fence on the borders of the Park, maintained vigilance by means of intensified stock inspections and the preventative vaccination of all susceptible stock in these areas.

The research activities of the Institute progressed satisfactorily and, although no spectacular "break-through" was made, valuable results were nevertheless obtained.

On 1st July 1971 there were 145 registered projects at the Institute. A further 28 projects were registered during the year while 19 were terminated. During the period under review 76 scientific articles were published.

Continued studies on the duration of immunity in cattle after experimental inoculation against besnoitiosis (elephant skin disease) revealed that the immunity after two years was as good as after one year. With this information at our disposal, as well as the results of experiments to determine a practical vaccine dose, the vaccine will now be registered and should be available for general use during the following year.

Promising results were obtained in the treatment of bilharzia in cattle with a cheap organic phosphate and a survey of the seasonal incidence of round worms in sheep in the Eastern Free State gave valuable information which should contribute towards the more effective control of these parasites. Methods have been evolved to evaluate the efficacy of worm remedies in cattle and standards of efficacy for such remedies have been established.

In the previous annual report it was mentioned that the disease "facial eczema", which is caused by a fungus, was also diagnosed in the Republic for the first time, and that attempts were being made to grow the fungus artificially in order to study the effect of the toxin. Although the fungus can be grown artificially with relative ease, the yield of toxin was limited.

After considerable research it was found that ultra violet light irradiation increased the toxin production of fungus cultures remarkably, which facilitated the artificial production of cases of facial eczema with these cultures. This enabled the research workers to study the disease closely and to compare it with natural cases of "geeldikkop". There is a suspicion that "geeldikkop" is also caused by a mycotoxin and, although suspected fungi have been found on pastures, the syndrome could not be produced artificially up to the present.

In the previous report it was mentioned that progress was made with the cultivation of the heartwater organism in laboratory host systems. Further research has since shown that either the organism cannot be grown in sufficient quantities, or is altered to such an extent that its use as a vaccine is not practicable. It is therefore apparent that the possibility of producing a safe and effective vaccine against heartwater is not yet within reach and further research in this direction is still necessary.

The most important occurrence during the past year was the diagnosis and confirmation of *chlamydiosis* as a cause of extensive abortions in sheep in the Republic. This disease, occurring overseas in enzootic

form called enzootic abortion, appeared throughout the country causing extensive economic losses. Research workers at the Institute determined that, not only did the organism cause abortions in sheep, goats, cattle and horses, but that it was also responsible for poor growth, nervous symptoms, pneumonia and mortality in young lambs.

Although the disease was only diagnosed and confirmed for the first time during this year, it is suspected of having been present in this country for several years in enzootic form, but that conditions for the disease were favourable, leading to its explosive appearance during this year.

The opinion of farmers that bluetongue vaccine produced by the Institute, was responsible for spreading the disease has been proved to be wrong by intensive investigations.

The only way enzootic abortion in sheep can be controlled is by means of vaccination. In addition to extensive diagnostic work and a study of the organism, a team of research workers at the Institute are engaged in developing a vaccine against the disease, which it is hoped will be issued early in 1973.

By the addition of two new vaccines viz. infectious bronchitis in poultry and HEP vaccine against rabies in cats, the number of vaccines produced and issued by Onderstepoort have now been increased from 30 to 32. The total number of doses of vaccine issued showed a phenomenal increase from 112 million in the previous year to 128 million during the year under review.

During the past year considerable progress has been made in research concerning the technology of vaccine production. For many years problems were encountered in the successful application of the WHO efficacy test to rabies vaccine — a problem also experienced by other laboratories. The test is based on the immunization of guinea pigs with a certain vaccine batch and then challenging these animals, together with unvaccinated controls, with a standardised dose of natural rabies virus. The problem was that the vaccine did not attain the requisite standard of efficacy, unless the challenging dose was sufficiently increased to kill a satisfactory percentage of the control guinea pigs. By the addition of a mucolytic enzyme to the challenge material the problem was solved and a scientific break-through established.

In the field of technology success was also attained with the production of distemper vaccine in an established tissue culture cell line instead of in incubated eggs. Not only did this save a lot of labour, but the quality and viability of the vaccine was also enhanced. The experimental work in connection with an oil

adjuvant vaccine against botulism (lamsiekte) was also completed and this improved vaccine will be available shortly.

Research on a vaccine against vibriosis has progressed very satisfactorily. A trivalent, inactivated, water-in-oil emulsion experimental vaccine gave effective protection to heifers against artificial infection. More important, however, was the fact that infected heifers lost the infection two to three weeks after vaccination. This same therapeutic effect was also observed in infected bulls. Technical problems in connection with the production of this vibriosis vaccine are now being attended to.

The standards of safety and efficacy of Onderstepoort vaccines have been reviewed during the year and considerably improved. Certain test procedures have been modified and new procedures introduced in order to meet these requirements.

NOTIFIABLE DISEASES

Foot and mouth disease

No outbreaks of foot and mouth disease occurred outside the Kruger National Park, except one case in an impala in a private game reserve in the Pilgrim's Rest district and one outbreak amongst 9 cattle in a game camp on a farm in the Barberton district. To limit infection in the latter case, 25 pigs were destroyed and R400 compensation paid.

As a precautionary measure 232 505 cattle, 13 492 sheep and 110 568 goats were immunised in the areas contiguous to the Kruger National Park, using an inactivated, trivalent vaccine which affords protection against all three South African types of foot and mouth disease virus — SAT1, SAT2 and SAT3.

In the previous report reference was made to infection in game in the Kruger National Park. During the latter half of 1971 infection was still prevalent, but gradually subsided thereafter.

To minimise the risk of the spread of infection through human agency, strict measures were enforced throughout the year within the Park. In connection with game animals slaughtered during culling operations, veterinary inspections were carried out of all carcasses, as well as veterinary supervision of the transport of carcasses to the abattoir and the pre-treatment of loads of fresh hides and skins before long-distance transport within the Park. To prevent the possibility of the spread of infection beyond the borders of the Park, cooking and chemical or other treatment of all animal products, prior to removal from the Park, was supervised by officials of the Division.

REPUBLIEK VAN SUID-AFRIKA
REPUBLIC SOUTH OF AFRICA

VEEARTSENYKANTORE
VETERINARY OFFICES

- ▲

Direkteur Veeartsenydiens

Director Veterinary Services
- Asst.-Direkteur

Asst. Director
- Staatsveearts

State Veterinarian
- Veterinêre Streeklaboratorium

Regional Veterinary Laboratory
- Staatsveeartswykgrense

State Veterinary Areas Boundaries
- Streekgrense

Regional Boundaries
- 1

Winterreënstreek

Winter Rainfall Region
- 2

Oos-Kaap en Karoo

East Cape and Karoo
- 3

Transkei

Transkei
- 4

Natal

Natal
- 5

Oos-Transvaal

East Transvaal
- 6

Transvaal

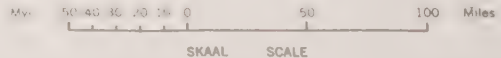
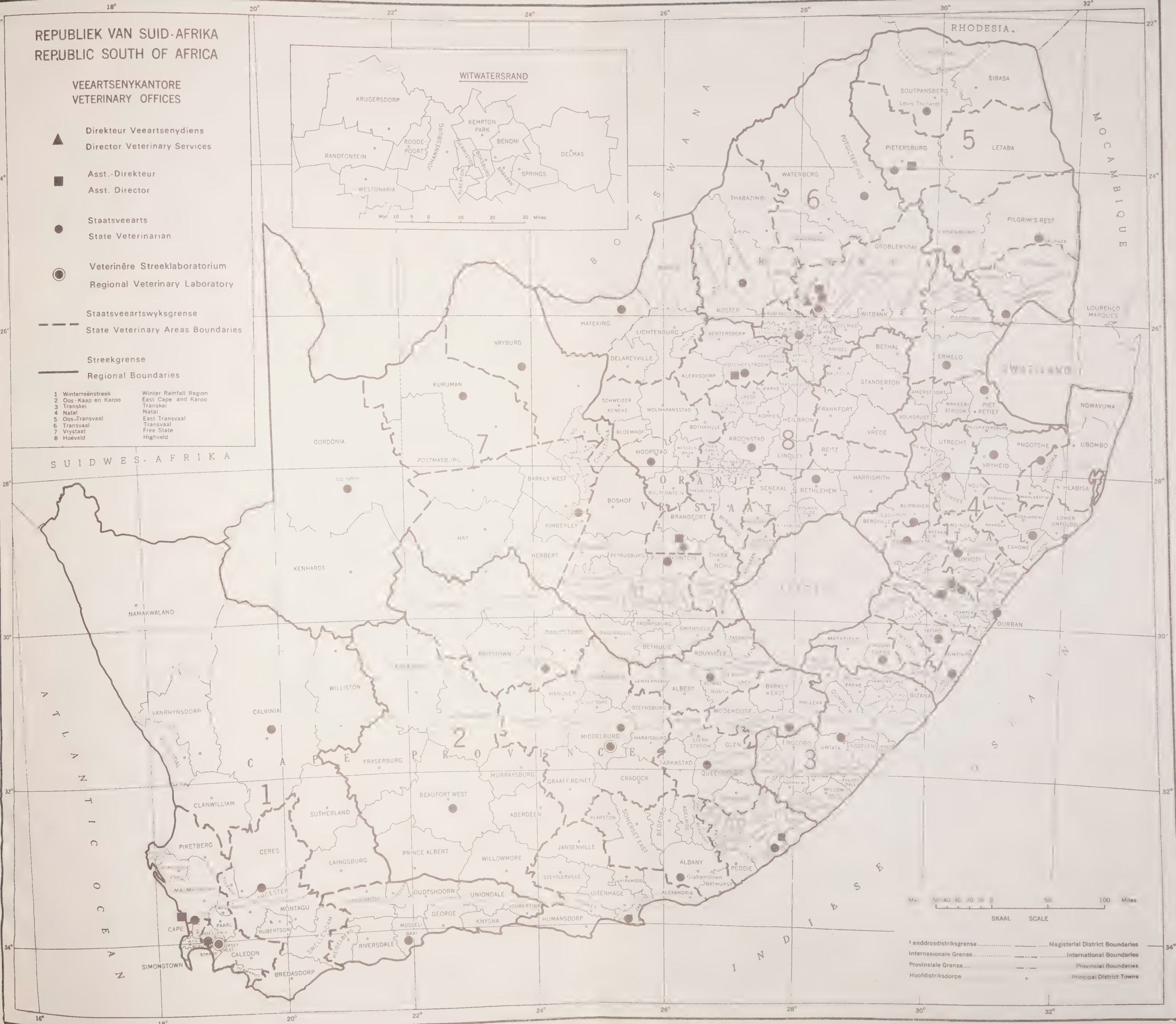
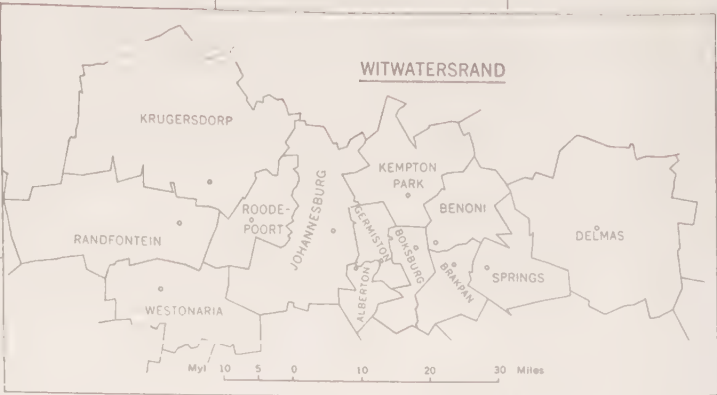
Transvaal
- 7

Vrystaat

Free State
- 8

Hooiveld

Highveld



- 1 androdistriksgronse Magisterial District Boundaries
- Internasionale Grense International Boundaries
- Provinsiale Grense Provincial Boundaries
- Hoofdistriksdorpe Principal District Towns



Further measures to protect stock farming areas from foot and mouth disease included short interval stock inspections in the areas adjoining international borders and the Kruger National Park, as well as regular patrol and repair of fencing on international and Kruger National Park borders.

As a result of border patrolling 34 cattle, 5 sheep and 43 goats found straying or illegally introduced from adjacent territories, were impounded. Of these, 11 cattle and 3 goats were returned to Botswana on payment of a total of R73 herding fees, while the rest of the animals, valued at a total of R1 248,50, had to be destroyed.

Rabies

During the period 1st July 1971 to 30th June 1972 a total of 1 989 specimens were submitted to the Rabies Section, Onderstepoort, for examination. Of these 450 (22,5 per cent) — this figure includes 73 from S.W.A. — proved positive, with the species distribution as follows:

Meercats	261
Cattle	97
Dogs	25
Domestic cats	15
Jackals	14
Sheep	4
Horses	3
Wildcats	1
Humans	1
Other animals	29

The significant increase — 1 260 — over the number of specimens submitted during the previous year is due, in part at any rate, to the public hysteria following the protracted illness and eventual death of a young girl in the O.F.S. after anti-rabies therapy. This case had received extensive press and radio cover.

A second contributory factor is the marked rise in the reported cases of rabies in certain wild life species, although this may have been influenced to a certain extent by the hysteria mentioned above.

The annual immunisation of dogs in the declared rabies areas in Natal and the Transvaal, and the vaccination of all dogs within a 15 — 25 km radius around confirmed outbreaks were carried out during the year. A total of 341 136 dogs and 13 889 cats were immunised.

The destruction of meercats by mobile units in heavily infected areas in the Highveld and O.F.S. Regions continued during the year. Eradication was undertaken on 333 farms (161 899 ha) and 47 239 colonies and 15 441 single holes gassed.

Anthrax

During the year 10 cattle and 1 sheep died in 10 outbreaks of anthrax on farms in the Republic. A total of 6 136 184 cattle, 176 075 small stock and 8 723 horses were vaccinated by or under supervision of officers of the Veterinary Division. Taking into consideration the fact that so many of these officers were absent from their areas on campaign duties for lengthy periods, the figures for precautionary immunisation are very satisfactory.

Since the 1970 outbreak of anthrax in the northern parts of the Kruger National Park, all anthrax carcasses found have been incinerated in an attempt to minimise the sources of infection. It would appear that this has led to an improvement, since the disease this year claimed only 2 roan antelope, 3 kudu, 1 buffalo, 2 steenbuck, 1 nyala and 1 impala.

As the roan antelope appears to be especially susceptible to anthrax, an experiment was launched to immunise animals of this species, using a helicopter and darts which also effectively mark vaccinated animals. In this way 89 roan antelope were immunised. At the moment expenses are high — R14 per animal — but it is hoped to bring this down by modification of the modus operandi.

East Coast fever and related diseases

East Coast fever was eradicated in 1954. In the formerly affected areas continued vigilance is maintained, and spleen smears are collected for laboratory examination from the highest possible percentage of cattle that die or are slaughtered in these areas. A total of 295 029 smears were examined during the year.

The fencing of the eastern and western boundaries of the Corridor, which prevents contact between cattle and the buffalo in the reserve, is probably responsible for the fact that no cases of buffalo disease *Theileria lawrencei* occurred.

Benign bovine theileriasis *T. mutans* was diagnosed in 42 cases. These outbreaks were controlled by short periods of quarantine and intensified tick control measures.

Tuberculosis

A total of 1 611 certificates was issued to tuberculosis free herds during the year under review and at the end of the period 2 899 herds were participating in the eradication scheme, compared to 2 084 the previous year.

During the financial year ending 31st March 1972 566 herd tests were done on 412 infected herds. In these herds 102 922 animals were tested and 5 722 found positive, giving an incidence of infection of 5,57 per cent. Of the 412 infected herds, 35 that are heavily infected are being given Isoniazid (INH) treatment.

During the financial year 4 281 positive reactors were slaughtered and R453 766 compensation paid by the State. The sale of carcasses not condemned at the abattoir realized the sum of R234 484, so that 51,6 per cent of the compensation paid was recovered.

Test and transport fees paid to private veterinarians in respect of tests carried out on behalf of the State came to R163 652. A further R21 000 for INH and ear tags brought the total expenditure on the scheme during the financial year to R638 418.

As the end of the year under review 230 private veterinarians had contracted to undertake testing on behalf of the State.

Since the launching of the eradication scheme on 14 May 1969, 139 herds previously infected have qualified for tuberculosis-free certificates.

An indication of the areas, where the heaviest infection was found, is given by the numbers of reactors slaughtered at the various abattoirs: Newtown (Johannesburg) 1 834, Maitland (Cape Town) 1 453, Port Elizabeth 260, Pretoria 212, East London 168, Pietermaritzburg 128, Kimberley 89, Durban 83 and Bloemfontein 33.

A summary of the tests carried out during the year under review is given below:

Only two outbreaks of avian tuberculosis were reported during the year, both in the Winter Rainfall Region.

Brucellosis

On 13 December 1968 the scheme for the official vaccination of heifer calves between three and ten months of age, and the distinctive marking of all such calves, was launched. As in the preceding two years, no gratifying progress under this scheme can be recorded for the year under review. A full-scale vaccination effort could not be maintained because of the campaign requirements of the Division and also the restrictions on transport allocations of inspectorate personnel.

At the Onderstepoort and Regional Investigation Centres the following serological tests for brucellosis were carried out:

Species	Number of tests	Result	
		Positive	Suspected
Cattle	73 904	9 965 (13,5%)	2 562
Sheep	5 585	626 (11,2%)	121
Goats	100	4 (4,0%)	—

During the year Onderstepoort issued 1 447 605 doses of Strain 19 and 421 350 doses of Rev. 1 vaccine. A total of 1 071 060 cattle and 5 610 sheep were vaccinated by or under supervision of officers of the Division.

At the Research Institute the immunogenic and agglutinogenic properties of three vaccines - Onderstepoort S19, Onderstepoort 45-20 killed oil

Test	Number of herds	Number of tests	Reactors	
			Positive	Suspected
INH.	19	9 163	566	146
Import and export	289	9 796	1	—
Diagnostic	442	28 246	112	56
Interim	1 152	215 080	1 915	1 038
Accreditation	1 845	235 791	2 053	663
Total	3 747	498 076	4 647	1 903

Compared to 1970/71 the total number of tests carried out shows an increase of 94 511. Excluding tests under the accreditation scheme, the incidence of reactors is 0,99 per cent positive and 0,47 per cent suspected.

Losses due to the condemnation of pig carcasses at abattoirs did not assume the same proportions as in previous years.

emulsion vaccine, and a non-agglutinogenic French vaccine (PB), are being investigated in cattle. PB vaccine has excellent non-agglutinogenic properties, whereas the oil emulsion vaccine is only slightly less agglutinogenic than S19. Although the experiment is still in progress it is already obvious that the PB vaccine has provided little protection while S19 induced a good immunity.

Vaccinated and exposed animals in the above experiment have also been used to investigate the various

diagnostic serological tests. As a result of these investigations it appears likely that the simpler mercaptoethanol or Rivanol tests could be used in place of the technically more difficult complement fixation test.

The Rose-Bengal plate agglutination test is being investigated on sera from the above experiment and on routine specimens received at Onderstepoort. Initial indications are that the test will find application as a rapid and reliable screening test.

Trypanosomiasis

Nagana

During the year under review no cases of nagana were diagnosed in the Republic of South Africa, while positive cases were known to have occurred in certain localised areas in the Eastern Caprivi. The annual spraying operations were continued in Moçambique as well as in the Caprivi tsetse fly complex.

For the first time since commencing spraying operations in 1962, it was not necessary to spray in Rhodesia south of the Sabi River. The 1971 spraying operations were confined entirely to Moçambique in terms of the recommendations of the Interterritorial Committee for the Control of Tsetse and Trypanosomiasis in South-East Africa that these operations be essentially directed to consolidate the progress so far made.

Five spraying teams for the months of July and August 1971 and 3 spraying teams for September 1971 covered an area of 715 km², where a total of 5 917 km of parallel lines, riverines, valleys and contacts were sprayed, using 164 678,50 litres of a 5 per cent DDT wettable powder. A total of 10 955 kg of 75 per cent DDT wettable powder was used during this campaign. The contribution made by the Republic included one Senior Technician to control and co-ordinate the campaign as a whole, three officials to supervise spraying units, five 3-ton lorries with drivers, two Land Rovers, spares for spraying pumps and 120 drums of diesoline fuel for opening up access roads.

The financial contribution towards the campaign was as follows:

R.S.A.	Rhodesia	Moçambique
R13 107	\$4 455	849 569 Esc. (± R21 238)

The results of the 1971 spraying operations that are already available make it clear that the first phase of the spraying operations, originally planned to cover a period of ten years from 1962, has come to a satisfactory conclusion. On the basis of results obtained from traffic control points, cycle fly rounds, bait ox

surveys and test herds, it can now be claimed with confidence that a total area of 10 950 km², including 5 250 km² on the Moçambique side of the international border, has been freed from the tsetse fly. The tsetse fly therefore has been eradicated from all parts of the former tsetse-belt on the Rhodesian side of the Moçambique border, south of the Sabi River, and also from all territory on the Moçambique side up to a depth of at least 60 km east from the Rhodesian border and south of the Rio Save.

The total costs of the first phase of this project amounted to R508 965 of which Rhodesia contributed R196 319, the Republic of South Africa R170 393, and Moçambique R142 253.

As an essential measure the immediate task of the Interterritorial Committee, in planning the second phase of the project, is to hold the country which has been reclaimed up to the present Massengena-Chegamane road and to ensure that no land be lost to the tsetse fly in a southerly direction to the east of the line.

The Caprivi Tsetse Fly Complex

In accordance with the agreement arrived at the meeting held at Windhoek on 17 – 18 March 1971 by representatives from the Republic of South Africa, Angola and Botswana, three spraying teams were again made available by the Republic and four spraying teams by Angola. Owing to other commitments in certain priority areas, and limited supplies of insecticide it was not possible for Botswana to continue spraying operations along the western banks of the Chobe river.

The change-over from dieldrin to DDT wettable powder in 1970 gave rather disappointing results. The fly density increased in certain areas, followed by an increase in the incidence of sleeping sickness. It was therefore decided that dieldrex 15T again be used for the 1971 spraying operations. A total of 2 800 litres dieldrex T15 concentrate was used in Eastern Caprivi and 8 600 litres in Western Caprivi and adjoining areas of Angola. No spraying was done towards the south in Botswana.

The total costs of the campaign for the three South African spraying teams amounted to R18 630.

No spraying operations were undertaken in the Bwabwata area for the second year in succession and the indications are that this area has been reclaimed and is free from *Glossina morsitans*. Surveys will be conducted to ensure that no land is lost to the tsetse in this area.

The position in Zululand remains unchanged and no cases of trypanosomiasis were diagnosed amongst cattle in areas adjoining the Umfolozi, Hluhluwe, Mkuzi and Ndumu Game Reserves.

Dourine

During the year 1 458 serum specimens were examined at Onderstepoort 1 138 of which came from plans in the Republic and 320 from plans beyond our borders.

The distribution of the 32 positive South African cases was as follows: Benoni (1), Christiana (1), Potchefstroom (5), Potgietersrus (1), Pretoria (1), Rustenburg (1), Mafeking (3), Vryburg (3), Natal (9), the Transkei (7).

The positive reactors within the Republic were all either castrated or destroyed.

Details of the specimens from outside the Republic are listed below:

Country of origin	Number of specimens	Number positive
South West Africa	166	15
Rhodesia	103	0
Swaziland	24	0
Botswana	17	1
Zambia	4	0
Lesotho	3	0

Lumpy skin disease

Only sporadic outbreaks of lumpy skin disease, with low morbidity and a very mild course, were recorded.

320 538 doses of vaccine were issued by Onderstepoort, which is only slightly less than the previous year.

Sheep scab

Sheep scab was recorded in 6 of the 7 Veterinary Regions of the Republic, with outbreaks diagnosed on 54 farms and 2 Bantu areas in the following 18 magisterial districts:

Sasolburg (4); Babanango (6), Dundee (3), Newcastle (4), Nkandla (Bantu area), Nqutu (Bantu area), Utrecht (2), Vryheid (2); Lydenburg (8), Pietersburg (2); Gordonia (4), Kenhardt (3), Kuruman (1); Belfast (3), Benoni (1), Pretoria (2); Calvinia (7), Vredenburg (2).

A total of 197 110 head of small stock on infected and contact farms were dipped under official supervision at least twice at 8 to 10 day intervals.

In the majority of cases the source of infection could not be established. Owing to the large number of vacancies in stock inspectorates and the temporary absence of many officers from their normal spheres of duty, infections were not always discovered at an early stage. This almost invariably made the tracing of the source of infection impossible.

During April-June 1972 research workers from Onderstepoort undertook trials in Dundee and Newcastle districts to find a suitable substitute for BHC, the only approved dip against sheep scab. These observations have shown that one of the three organic phosphate sheep dips tested, gave excellent results against the parasite concerned, *Psoroptes communis ovis*. One dipping at 500 p.p.m. gave complete control, but two dippings at this strength were recommended for general purposes.

Mange

Sporadic cases of mange in cattle, goats and pigs were recorded, as shown below. All cases readily responded to appropriate treatment.

Species	Outbreaks	Number of Animals affected	Animals on farms
Cattle	38	427	50 682
Goats	48	5 637	60 379
Pigs	19	137	1 514

In the Witsieshoek Bantu Reserve in the O.F.S., 401 horses were dipped as a precautionary measure.

In the Kruger National Park mange was observed throughout in various species. *Sarcoptes scabiei* could be transmitted artificially only to the buffalo and steenbuck. It was found that the buffalo as well as the blue wildebeest can be asymptomatic carriers of sarcoptic mange.

Swine fever

Classical swine fever does not occur in the Republic and no cases of African swine fever were recorded during the year.

Warthogs and bush pigs — potential carriers of African swine fever — are found in a limited portion of the Northern and Eastern Transvaal, which has accordingly been declared a swine fever control area. Measures applied here include strict control of the movement of pigs and pork products within and out of this area. Only pigs from approved piggeries, which conform to certain specifications and are subject to regular inspections, are allowed to be moved out of the

control area, and then only to specified quarantine abattoirs from which no meat products may be allowed to enter the export trade.

During the year a survey was launched in the Potgietersrus State Veterinary Area to investigate the presence of African swine fever virus in tampons found in warthog burrows. Infection was found on two farms in the area.

Swine erysipelas

During the year 18 outbreaks of erysipelas were recorded, one causing the death of a dolphin in the Port Elizabeth Oceanarium. In all cases infection yielded readily to antibiotic treatment.

Epizootic lymphangitis

No cases of this disease occurred during the year.

Johne's disease

Four cases, all in imported bulls, were recorded, one each in the districts of Ladybrand, Krugersdorp, Pretoria and Thabazimbi. The four farms involved, as well as those on which cases occurred in previous years, are being watched for any further developments.

The Natal Region indicates that the Swaziland veterinary authorities have reported Johne's disease in a cow imported from a farm in the Hlabisa district. Infection was found on this farm some years ago after the introduction of an imported bull from the Pietermaritzburg district. The position on both these farms is being closely observed.

Infectious laryngotracheitis

Four outbreaks were confirmed in the Winter Rainfall Region. A total of 991 823 chicks were vaccinated experimentally during the year, and no severe reactions noted.

Rinderpest

This disease does not occur in the Republic of South Africa or any of its neighbouring territories.

Newcastle disease

In the previous report it was indicated that in view of the world-wide incidence of Newcastle disease and the situation in the Republic the policy of slaughter of infected flocks and official vaccination of poultry at risk was suspended on 13 January 1971, while the sale of Komarov vaccine to all poultry farmers for the protection of their stock was authorised. Also referred to was the decision on 18 February 1971 to permit the importation of water-soluble vaccines for use by owners to protect young stock.

During the year under review no policy changes were introduced. The recommendations for immunisation regimes for breeding, egg production and broiler plants were, however, adapted to ensure optimum results, in the light of experience gained in the large-scale use of the available vaccines.

The disease position did not improve during the period under review and there were widespread outbreaks, only the Cape East and Karoo Region remaining free of infection.

At the end of the year under review the position is that outbreaks are encountered mainly in small poultry holdings and backyard flocks not protected by the recommended vaccination programmes, but also in some larger establishments in similar circumstances.

At the Research Institute the evaluation of immunity in young chicks after inoculation with lentogenic vaccine virus (i.e. similar to drinking water vaccines eg. Lasota and B₁ strains) has been done and it was concluded that with chicks under four weeks old great problems are encountered in attaining an efficient immunity.

The most important findings were that day-old chicks immunize poorly. Passive immunity in chicks from Komarov strain vaccinated parent stock is sufficient to risk delaying vaccination till 5 to 7 days old when a considerably better immunity is conferred. This is now recommended as standard practice.

Chicks which are thereafter inoculated with Komarov vaccine at about 4 weeks of age show no reaction, but immunize well and only require a further Komarov vaccination at 16 weeks of age.

In broiler chicks the same problem was encountered with day-old immunization. Immunization at 7 days of age is regarded as practical in large broiler establishments.

Lasota vaccine by the intramuscular route was tested, because these types of vaccines are weaker than Komarov. This vaccine is normally not injected, but applied to the mucous membranes. In trials with tens of thousands of broiler chicks it was found that chicks inoculated intramuscularly with triple strength Lasota vaccine at 18 days old developed an excellent immunity which lasted till at least 9 weeks old. The practicability of these findings is being investigated.

Komarov vaccine gives the best immunity against prevalent, virulent, natural strains and when administered as prescribed no vaccine reactions are encountered. Komarov vaccine also has a "blocking" effect when administered on a farm where birds are dying from Newcastle disease. Mortalities may be

reduced by 45 to 65 per cent and this vaccine is used to save flocks where a breakdown has occurred on account of insufficient immunity. It was found that deaths are eliminated one week after a blocking dose in such flocks and that mortalities are limited to 2 – 15 per cent whereas this could be 30 to 45 per cent in flocks not so treated.

Since December 1971 all batches of imported vaccines are tested by Onderstepoort for efficacy. This consists of titrations before and after exposure at 37°C for one week.

So far 113 bottles of vaccine have been tested of which two batches did not attain the requisite standard.

Bacillary white diarrhoea and fowl typhoid

Four outbreaks of BWD (one in the flock of a certificate holder) and six of fowl typhoid (one in a certificate-holding flock) were reported during the year.

Data of tests performed in respect of these two diseases are summarised below:

Flocks tested	85
Birds tested	802 182
Positive reactors found	10
Suspected reactors found	14
BWD and FT and free certificate holders	86
Birds in certified flocks	1 835 857

In the previous report details were given of the characterisation of rough mutants of *Salmonella gallinarum* used for vaccine production. These strains give a solid immunity in the absence of smooth 'O' antibodies and experiments were undertaken to investigate the nature of this immunity.

This work is continuing.

Fowl cholera

No outbreaks of this disease were reported during the year.

Psittacosis

Three outbreaks, all in birds of the parrot family, were confirmed in the Transvaal Region, and one in the Highveld. In one of the Transvaal cases, two detectives, two Bantu labourers, 2 female clerks, one game conservation officer and one State Veterinarian came into close contact with a confiscated cage of presumably smuggled parrots. Only the State Veterinarian did not contract psittacosis.

Other notifiable diseases

Scrapie

No cases of scrapie occurred during the year. Regular inspections were carried out on the steadily decreasing number of flocks to which were traced in-contact sheep from farms where cases were subsequently confirmed. Permit control of all movements from these flocks was maintained.

Equine infectious anaemia

No cases of this disease were reported during the year.

Glanders

This disease was eradicated in the Republic many years ago.

Bovine pleuropneumonia

No cases of this disease occurred in the country.

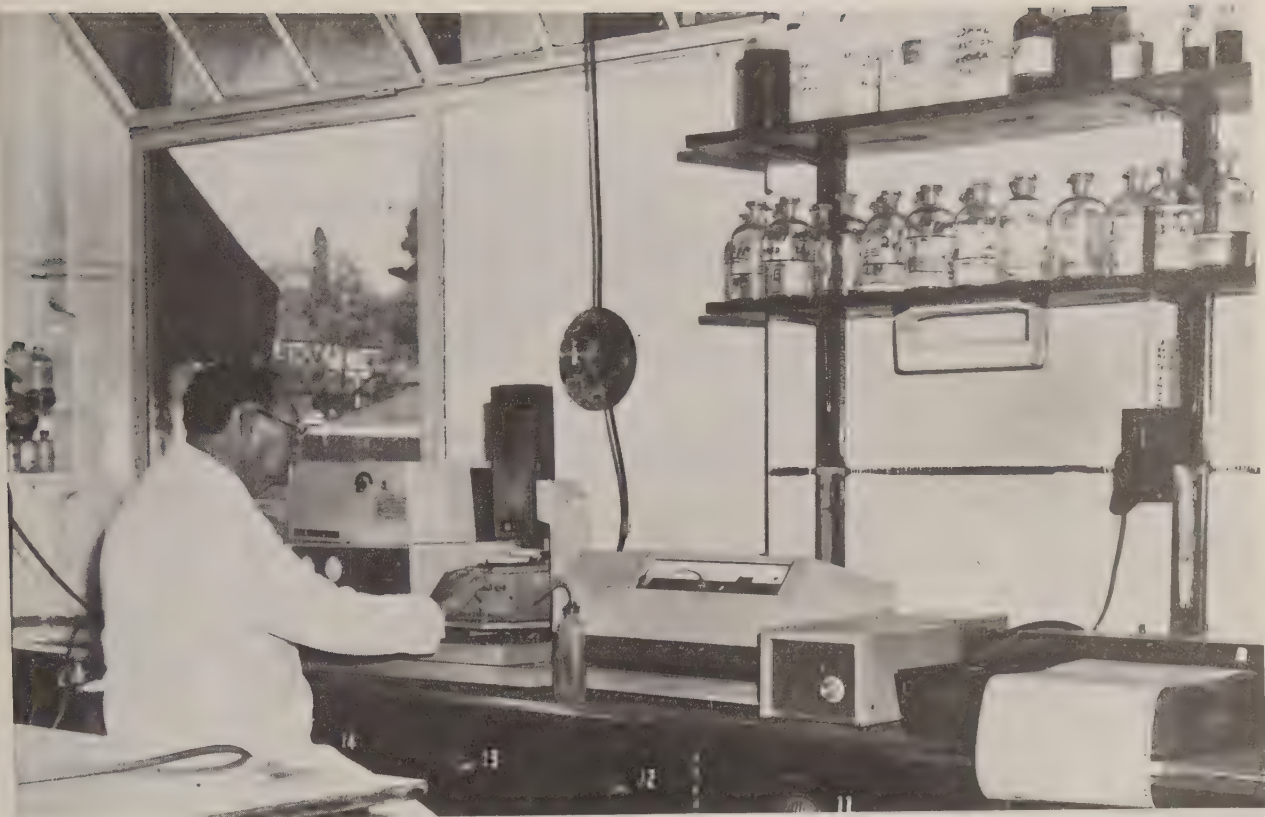
NON-NOTIFIABLE DISEASES

Deficiency and nutritional diseases

From the Highveld, Eastern Cape and Karoo, Eastern Transvaal and Transvaal Regions it is reported that as a result of the good rains, very few problems were encountered.

From Natal a general deficiency of phosphorus is reported. The Allerton Investigation Centre indicates that a method of approach that appears to have very important implications, is the study of metabolic profiles of problem farms, involving the measurement of minerals, protein and glucose. Protein and energy deficiencies have been detected by this means and imbalances corrected. From Ixopo avitaminosis A on heavily fertilised pastures, especially rye grass and kikuyu, characterised by retained placenta, poor conception and running eyes, is reported, as well as iodine deficiency with late pregnancy abortions and early calf mortality.

The O.F.S. Region reports aphosphorosis as widespread, but on account of the good season not of marked severity. Magnesium deficiency in sheep on green grazing was prevalent. In the Vryburg area avitaminosis B.1 caused death in ewes. Pathological examination confirmed the presence of necrotic areas in the brains of affected animals, and the administration of Thiamin remedied the condition.



An atomic absorption spectrophotometer used at Onderstepoort to measure mineral imbalances in animal feeding

In the Ermelo district of the Transvaal Region white muscle disease was confirmed in lambs in two flocks and copper deficiency was diagnosed in a herd of 200 cattle in the Piet Retief area.

The Winter Rainfall Region reports that copper deficiency remains one of the most important problems, especially in the coastal areas. Calcium and phosphorus imbalances are also fairly widespread. Dairy rations are often too high in protein content, sometimes coupled with mineral deficiencies.

In the Kruger National Park in the Eastern Transvaal Region surveys in respect of trace elements and possible phosphate deficiencies and phosphorus and other mineral imbalances are being conducted.

In connection with animal nutrition the Veterinary Research Institute reports as follows:

Mineral imbalances in cattle, sheep and pigs

The procedure of liver sample analysis for the diagnosis of mineral imbalances has developed into an efficient, accurate and rapid method of evaluation. Normal values developed from the means of several thousand analytical results are used as reference sources for future guidance.

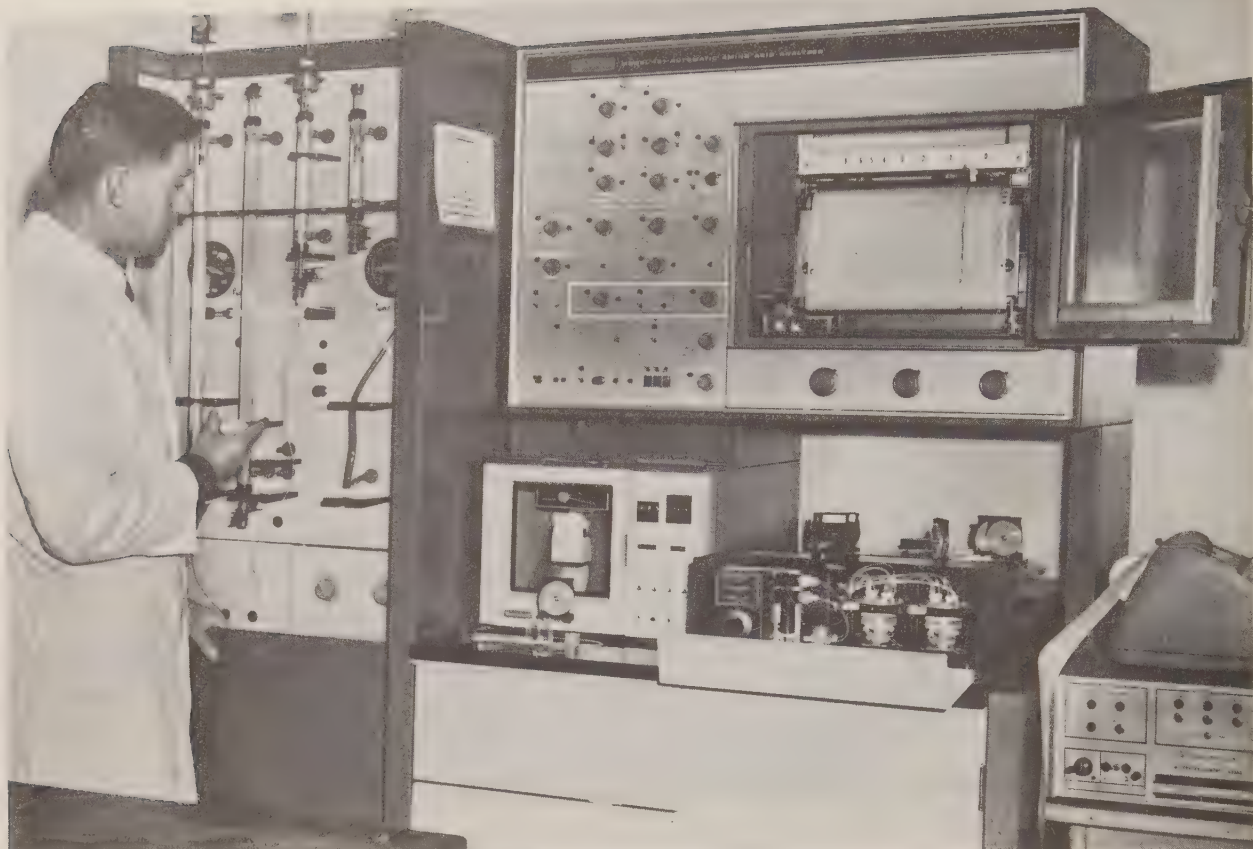
Samples are being received in batches from many areas for evaluation and primarily from the Highveld, Natal, Eastern Cape and Orange Free State.

The primary mineral imbalances encountered in the order of frequency have been deficiencies of copper, zinc, manganese, magnesium and cobalt. Sporadic cases of excess copper, selenium and iron (pigs) have also been diagnosed. Recommendations for supplementation are made through lick formulations suitable for the area.

Amino-acid – Mineral relationships in horse nutrition

Multiple bone deviations and related conformational problems are the result of imbalances between minerals and their relationship with protein supply in the diet.

In the first of a series of investigations on the digestive tract of horses, the sampling at the duodenum and colon by means of fistulae is being undertaken to evaluate the mineral and protein digestive procedures at these sampling sites. The basic nutrients thus far evaluated are lucerne, teff and oat hay. Currently maize, oats and bran are being investigated.



An automatic amino-acid analyser used to evaluate the efficiency of protein utilisation by animals

At this stage of the experiment it appears that the amino-acids which are playing a prominent role, from the digestion of teff, lucerne and oat hays, are glycine, serine and valine (blood); alanine, glycine and glutamic acid (colon) and alanine, glutamic acid and leucine (faeces).

The effect of non-protein nitrogen supplementation on the trace mineral balance of sheep

Considerable research has been conducted to determine to what extent non-protein nitrogen products can replace true protein in maintenance sheep rations. There are currently further investigations in progress to evaluate possible effects that such replacement has on the mineral balance in the breeding flock.

Breeding ewes on teff/lucerne hay rations are being fed licks containing yellow maize meal, salt, bonemeal and fishmeal or biuret.

Whereas it is premature to comment on the effects of the two treatments on mineral balance, there is a distinct difference in the acceptability of the licks in favour of that containing fishmeal. Apart from liver analyses lambing percentage and growth rates will also be evaluated.

Poisoning

Mineral poisoning

Numerous instances of poisoning were reported from all the Regions, in several instances accompanied by heavy mortality. Many cases resulted from incorrect or negligent use of such material as urea, acaricides and salt, the accidental or malicious administration of acaricides or other insecticides, and the ingestion of harmful substances such as lead and nitrates.

In one of the worst cases approximately 300 cattle were lost in Natal owing to an overstrength arsenical dip. Twenty died as a result of hand-dressing with an overstrength arsenical mixture, and 52 died from organo-phosphate poisoning.

Uncontrolled copper spraying in an orchard was responsible for the death of cattle in the Eastern Transvaal district of Lydenburg, while 23 head died after organo-phosphate dipping in the Pietersburg district.

Two severe outbreaks of water poisoning as a result of mineralised water were reported from Upington in the O.F.S. Region, while the Winter Rainfall Region

reports heavy losses in the Calvinia area from kidney and bladder stones in sheep resulting from drinking water with an excessive mineral content.

Research workers state that it was recently discovered that a skeletal abnormality in fast growing broilers can be effectively counteracted by high copper supplementation in the feed. This has become accepted practice with several of the large commercial broiler producers.

The greatest amount of the added copper is excreted in the chicks' faeces and two instances of chronic copper poisoning in ruminants were encountered where these animals received relatively large amounts of chicken manure as part of their ration.

As it may take several months for sufficient copper to be accumulated to toxic levels and as the feeding of chicken manure is a fairly general practice further outbreaks may be anticipated.

The danger of dieldrin treated seed was emphasised during the past year by the increased number of outbreaks of poisoning in cattle and birds. In the former cases leftover mealie seed was involved and in the latter instance a wholesale concern released treated manna to retailers with the result that numerous outbreaks of poisoning in aviaries were encountered.

Haloxon is an organo-phosphate anthelmintic with an exceptionally low mammalian toxicity. Research has indicated that at approximately twenty times the therapeutic dose it does produce a chronic neurotoxic syndrome typical of certain organo-phosphates which is unrelated to the usual symptoms due to cholinesterase inhibition.

Carbon disulphide (CS₂) is used for the treatment of bots in horses and over the years the simultaneous dosing of these two compounds in horses became a standard practice with many veterinarians.

During 1971 a severe mortality in horses occurred at two establishments on the Rand in which a total of 44 horses died and 60 were destroyed. The syndrome consisted of paresis followed by paralysis and sometimes paralysis of the vocal cords (roaring) and death from asphyxia. During 1970 29 horses on 5 establishments in South West Africa also exhibited symptoms with the combined use of Haloxon and CS₂.

Experiments revealed that at as much as 8 times the therapeutic dose, Haloxon alone had no deleterious effect on the horse and that double the normal dose CS₂ did not produce these signs. However when CS₂ at a normal dose, was combined with Haloxon at just above the therapeutic dose of 75 mg/kg, it resulted in dramatic enhancement of the chronic neurotoxic effect of this

organo-phosphate. The lesions found were scattered individual neuronal degeneration and necrosis in especially the *medulla oblongata* and spinal cord.

Plant poisoning

As a result of sufficient rains grazing was plentiful during the greater part of the year and plant poisoning did not assume the same significance as in drier years.

Regional reports indicate that the following were the major causes of stock deaths: tulp *Homeria* and *Moraea* spp. in the Highveld, Natal, Eastern Cape, Eastern Transvaal, O.F.S. and Transvaal Regions; *Senecio* spp. in the Natal, Eastern Cape, O.F.S. and Transvaal Regions; vermeerbos *Geigeria* spp. in the Highveld, O.F.S. and Transvaal; gousiekte bush *Pachystigma pygmaeum* and *Pavetta* spp. in the Eastern Transvaal, O.F.S. and Transvaal; slangkop *Urginea* and *Ornithoglossum* spp. in the Highveld and O.F.S.; *Crotalaria* spp. in the Eastern Cape and O.F.S.; *Lantana camara* in the Eastern Transvaal and Transvaal; *Tribulus* spp. in the Highveld and O.F.S.; inkberry *Cestrum laevigatum* and *Matricaria nigellaefolia* in Natal, and melktou *Sarcolstemma viminale* in the O.F.S.

In the only case of stinkweed *Datura* spp. poisoning reported, two thoroughbred horses valued at R15 000 died in the Piet Retief district of the Transvaal.

Toxins

Only isolated cases of *Diplodia zae* poisoning and aflatoxicosis were recorded, and one instance of botulism-like symptoms in cattle fed on mouldy silage. One week after withdrawal of the silage, 12 of the 15 affected cattle recovered.

Mycotoxicological research at the Veterinary Institute is carried out in conjunction with the Plant Protection Research Institute.

Extracts of *Phomopsis leptostromiformis* cultures causing lupinosis in the Cape, and toxic for young guinea pigs at 2,5 mg/kg, were obtained by various chemical procedures. Purification beyond this level has thus far failed owing to technical difficulties arising primarily from the high polarity and/or lability of the substance.

During studies on aetiology of geeldikkop the sporidesmin content of *Pithomyces chartarum* cultures was increased 100 fold by near ultra violet light irradiation. In this way sufficient sporidesmin was obtained to reproduce facial eczema experimentally for the first time in South Africa with a local isolate.

An acute haemorrhagic syndrome with hepatitis and icterus was produced in equines by dosing with pure maize cultures of *Fusarium moniliforme* (the cause of

encephalomalacia in horses). The condition somewhat resembled lupinosis and it is the first time ever that this syndrome had been produced in South Africa.

Another mycotoxicosis was experimentally reproduced for the first time in South Africa by feeding a local isolate of a *Myrothecium* sp. to a sheep. The principal lesion produced was a severe haemorrhagic abomasitis.

Bacterial diseases

Mastitis

Mastitis remained the most important factor in the economics of dairy farming.

With the manpower available no concerted anti-mastitis action was possible. Milk examinations, which included anti-biogram tests where necessary, were conducted in all Regions on as extensive a scale as possible. This enabled the best advice on the problem to be given in every instance.

"Blue udder" in sheep occurred fairly extensively in the Winter Rainfall Region, while in the Transvaal many cases of this condition, and mastitis in sows, were encountered.

During the course of investigations at Onderstepoort, 16 250 quarter samples of milk from various dairy herds were examined. Of these 25 per cent were positive for the presence of mastitis-causing bacteria. An initial evaluation of the data collected from these investigations facilitated the establishment of essential background information as pointed out in the previous report.

It has also become apparent that improvements achieved by therapeutic and hygienic measures are of limited value in dairy cows possessing a genetic predisposition to mastitis. The importance of morphological, inheritable predisposition in the pathogenesis and epizootology of infectious mastitis is acknowledged. However, no data are available on functional hereditary predisposition.

From data obtained it appears that hereditary functional features of the udder could constitute a predisposition of major importance in the aetiology of infectious forms of bovine mastitis. Cows secreting the AB-variant of beta-lactoglobulin showed a significantly lower incidence of mastitis than cows with either the A or B-variant of beta-lactoglobulin. A similar tendency is present in cows with the AB-variant of Kappa-casein; however, the result obtained is not statistically significant probably owing to the small number of cows examined.

These initial findings are encouraging and a follow-up of this by examination of more material is important since it is anticipated that the most "mastitis resistant" animals will be found amongst the B-homozygotes and the most "mastitis susceptible" animals amongst the A-homozygotes. It is also of importance to establish how the secretion of certain gene-types of beta-lactoglobulin and of alpha-, beta-, and kappa-caseins is linked with high or low producing animals since high producers are more prone to udder-infections than low producers.

Furthermore it is the intention to determine whether any correlation exists between gene-types of milk-proteins and gene-types of blood-proteins, in which case a typing-procedure might be evolved which would facilitate the early discovery of high or low producers and "mastitis resistant" or "mastitis susceptible" animals. It is also the intention to determine whether there is a correlation between a certain gene-type of milk-proteins and the success of intramammary mastitis therapy.

In the examination of cream, milk and sediment smears for the cytological and bacteriological diagnosis of mastitis, statistically significant correlations exist between most of the diagnostic methods used. All the methods tested are only of relative reliability in cows during early lactation. In later stages of lactation methods tested — including electronic cell-counting — are considered unreliable and inadequate for diagnostic purposes. The above is also applicable to the original MORRIS-HOBBS MASTITIS TEST since the latter was based on a polyvalent antiserum. However, results established with a modified MORRIS-HOBBS TEST employing specific monovalent antiserum are very promising.

This test has the potential of becoming the first mastitis test able to provide a reliable diagnosis of epithelial damage occurring in the udder due to infection or physical or chemical trauma. The development of the original MORRIS-HOBBS TEST into the more sensitive modified test has been achieved by close co-operation between the Mastitis Research Unit of the Veterinary Research Institute, Onderstepoort, and the Virus Research Unit of the Medical School, University of Cape Town.

Enterotoxaemia

Pulpy kidney disease presented no problems in flocks where the recommended vaccination programmes were adhered to and did not occur extensively anywhere.

During the year Onderstepoort issued 30 923 350 doses of vaccine, 1 050 700 less than during 1970/71.

At the Research Institute, extensive investigations into the purification of prototoxin of this organism have been carried out and methods of assaying anti-toxin and toxin have been developed.

It has been found that of the body tissues only brain and to a lesser extent kidneys, absorb appreciable amounts of toxin. This finding indicates a specific binding site for toxin in brain and possibly kidney tissue. This theory is further supported by the finding that large doses of toxoid given a few hours before toxin protects mice against 16 MLDs of toxin.

Blackquarter

Outbreaks of blackquarter were recorded in all parts of the country, in sheep, especially after shearing, as well as in cattle.

In view of the efficacy of the vaccine available, it is most unfortunate that such large numbers of animals are allowed to die of this disease every year. This applies to both Bantu and White farmers.

Onderstepoort issued 4 645 638 doses of vaccine during 1971/72, 180 676 less than the previous year.

"Lamsiekte"

The vaccine against botulism is very effective so that outbreaks of this disease are usually sporadic only and severe losses are the exception.

During the year over 200 cattle valued at R30 000 died in a feedlot in an outbreak in Natal as a result of the accidental feeding of spoiled carcase meal intended for use as fertiliser. In one outbreak in the Winter Rainfall Region a farmer lost all his cattle: these had been held with no supplementary feeding in a bare camp, where sheep carcasses were thrown to obviate the labour of burying or burning them.

Dead muscovy ducks in a drinking trough caused the death due to botulism of 11 dairy cows in the Transvaal Region. An owner who did not believe in the destruction of carcasses — at the time of investigation one sheep carcase was found in the feed trough — suffered severe losses in sheep and horses in an outbreak in the O.F.S.

The feeding of garbage from a mine compound is suspected of being responsible for a severe outbreak in the Highveld Region.

Corynebacteriasis

All Regional Reports refer to the prevalence of this disease in both cattle and sheep. There are indications that the incidence is rising.

The disappointing results so far obtained with preventative vaccination are underlined by reports received from the Natal, Eastern Transvaal and O.F.S. Regions.

Pasteurellosis

Only sporadic outbreaks, mainly of a minor nature, occurred over the greater part of the Republic. From the O.F.S. Region relatively high mortalities in lambs were reported on many farms. In the Winter Rainfall Region the spread of the disease in the sheep areas is causing alarm. This is especially the case where sheep are fed during drought periods or on grain farms. Serious problems are also being experienced where the large-scale rearing of beef calves is undertaken.

Tetanus

Only a few cases were recorded and the disease is of very little importance in South Africa.

Colibacillosis

Escherichia coli infection is reported to be the greatest single factor in perinatal calf and lamb mortality and is also responsible for heavy losses in piglets and chicks. Outbreaks are almost invariably triggered off by sub-standard conditions of hygiene.

Some doubt appears to exist about the efficacy of the available vaccine.

Leptospirosis

At the Stellenbosch Investigational Centre 406 of the 5 488 specimens examined for leptospirosis were found positive and at Onderstepoort 39 of the 2 354 examined. Cattle, pigs, horses and dogs proved positive to a wide range of serotypes.

In one herd of cattle and one of swine in Natal, leptospirosis was originally incriminated as the cause of an abortion storm and breeding troubles, but subsequently grave doubts have arisen as to whether leptospiral infection played any role in the aetiology.

No definite proof has been presented that leptospiral infection is of economic significance.

Vibronic dysentery of pigs

In the majority of Veterinary Regions no outbreaks were recorded and in the rest only a small number of isolated cases.

Pseudomonas infection

Only the O.F.S. Region reports the confirmation of this organism as being the cause of a limited number of cases of mastitis in cows and "blue udder" in sheep.

Lamb dysentery ("Bloedpens")

Only one case of this disease was recorded during the year, in the Highveld Region.

Actinobacillosis and actinomycosis

A few isolated cases of these infections were recorded, but the condition is of little significance.

Staphylococcus aureus

The major cause of bovine mastitis in all parts of the Republic was again found to be *S. aureus*. From the O.F.S. and Winter Rainfall Regions it is also reported to be the chief cause of mastitis in ovines.

Protozoal Diseases

General

As a result of the good rains and other favourable climatic conditions, tick life flourished in most parts of the country and tick-borne diseases assumed more than average importance.

Babesiosis

Redwater in cattle was again most prevalent in the coastal areas of the Eastern Cape and in the Natal and Transvaal Regions where it is of great economic importance. In the Eastern Transvaal, Highveld and O.F.S. Regions a limited number of outbreaks occurred, but the incidence is reported to be on the increase in the latter two areas. Frequent outbreaks were encountered in the eastern coastal strip of the Winter Rainfall Region.

At the Research Institute the infectivity of the blood of splenectomized cattle infected with either *Babesia bigemina* or *B. bovis* was studied with a view to elucidating the unsatisfactory results obtained with Onderstepoort redwater vaccine in the field. It was found that as soon as 2 and 4 months after infection with *B. bovis* and *B. bigemina* respectively, 2,5 ml blood, constituting a vaccine dose, was no longer uniformly infective despite the fact that transfusions of 500 ml blood revealed that the respective donors were still harbouring low level infections. This investigation clearly indicated that the use of blood from active cases is essential for vaccine production and this is now being implemented.

Various dipping procedures on a farm in the Ixopo district gave an indication that short-interval dipping was detrimental to the immunity against redwater. Animals not dipped for twelve months were far more resistant than those dipped regularly.

A survey of blue ticks in the districts of Port Shepstone, Umzinto and Ixopo showed that *Boophilus*

microplus was the dominant *Boophilus* species. Out of a total of 2 380 blue ticks received for identification 91,5 per cent were *B. microplus* and 8,5 per cent *B. decoloratus*.

Tick transmission of *B. bigemina* was successful using *Boophilus microplus* originally obtained from Port Shepstone.

Canine biliary fever was prevalent in most parts of the Republic, but *equine biliary fever* occurred only in isolated cases.

Anaplasmosis

Gallsickness cases occurred widespread in the Republic, but did not constitute a serious problem anywhere.

Issues of the improved vaccine referred to in the previous report amounted to 368 642 and 46 081 doses from Onderstepoort and Allerton respectively, a decrease of 80 261 doses compared to the total issue for 1970/71.

An experiment on the pathogenicity, longevity and immunogenicity of anaplasmosis vaccine, obtained from splenectomized donors and packed on ice, produced some rather unexpected results. It was found that *Anaplasma centrale* was considerably more pathogenic for adult susceptible cattle than has hitherto been thought to be the case. Fairly severe to severe anaemia was observed in all 13 vaccinated animals. One died from typical anaplasmosis and a second animal would have succumbed if it had not been treated specifically. The height of the reaction was reached approximately 6 weeks after inoculation. It was usually accompanied by mild fever and maximum anaemia was recorded a few days later. The longevity of the vaccine was well in excess of the expiry date recorded on the label. When the animals were challenged 3 months after vaccination with *A. marginale* one (8 per cent) reacted as severely as the controls whereas eleven (92 per cent) were protected against the development of clinical signs, but not against infection.

In view of the excellent longevity of the above-mentioned vaccine the possibility of reducing the dose used has arisen and is being investigated.

Besnoitiosis

No spread of elephant skin disease was reported within or from the known enzootic areas.

Laboratory and field trials on the efficacy of a living vaccine prepared from a strain of *Besnoitia besnoiti* isolated from blue wildebeest were continued.

Cattle vaccinated at the laboratory more than 2½ years previously were challenged with a large intravenous inoculum of a bovine strain of *B. besnoiti*. They developed mild febrile reactions and small numbers of cysts were detected at slaughter. The controls, on the other hand, showed fairly severe clinical reactions characterized by pronounced pyrexia, inappetence, mild anasarca, microscopically detectable parasitaemia and relatively large numbers of cysts.

Evidence of a durable immunity was also obtained in field trials. Of the approximately 2 000 head of cattle vaccinated at least 2 years previously, 1 434 were still available for a study in the winter of 1971. They were examined for evidence of infection by scrutiny of the scleral conjunctiva for cysts in the usual way. Analysis of the results revealed that 0.6 per cent (9) of the vaccinated animals had contracted a mild subclinical infection over the 2 years. In contrast, the infection rate in the controls was 27.4 per cent (21), 2.4 per cent (4) of which showed typical clinical signs, the balance being subclinically infected. From these figures it can be calculated that 100 per cent of the vaccinated animals were protected against the clinical form and 97.9 per cent against the subclinical form of besnoitiosis over a period of two years after a single inoculation.

Coccidiosis

Sporadic outbreaks of coccidiosis in cattle, calves, sheep, lambs and poultry were confirmed during the year in all parts of the country. Outbreaks in cattle and sheep occurred mainly on artificial pastures or in feedlots.

Virus diseases

Bluetongue

Relatively few outbreaks of bluetongue were recorded during the year, except in the O.F.S. Region, where many outbreaks occurred in both vaccinated and unvaccinated flocks, and in the Winter Rainfall Region where the disease was encountered mainly in the Calvinia area. Outbreaks were in general not accompanied by severe losses.

Research workers at the Institute report as follows:

Bluetongue

In a project designed to determine additional facets of the role of cattle in the epizootiology of bluetongue it was found that colostrum deprived calves, when infected with bluetongue virus, showed no deviation from the pattern of viraemia previously encountered in experiments conducted in adult cattle in this country. The experimental animals remained clinically unaffected and viraemia was of only short

duration. The significance of the fact that one of the calves failed to show any detectable immunological response in spite of infection, remains to be determined.

Trials were commenced with the object of developing an inactivated vaccine against bluetongue. Vaccines prepared by the addition of formalin and incorporating an oily adjuvant have given a good immune response in adults and young lambs.

Multiplication of the bluetongue virus

Based on the fact that the bluetongue virus, as well as the virus causing horsesickness, possess a double-stranded RNA genome, it has been suspected for some time that these viruses should have an extraordinary multiplication mechanism. Because this form of RNA does not generally occur in normal cells, these cells normally do not possess an enzyme to manufacture or utilize double-stranded RNA. It was, therefore, clear that the diplomnaviruses, as the group is called, should either possess such an enzyme or should be able to stimulate the infected cell to the synthesis of this enzyme. The latter possibility has been excluded experimentally and the logical conclusion was that the bluetongue virus, in contradistinction to most other viruses, possesses its own RNA-dependant RNA-polymerase. All previous attempts to confirm this suspicion have, however, failed. No enzyme activity could be found in the virus *in vitro*.

During the past year an intensive study was made of the polypeptide components of the protein cover of the bluetongue virus. Four chief components and three subcomponents were found. It was further discovered that two of the chief components form a diffuse layer on the virus capsid or cover. These two polypeptides can be removed selectively by exposure to high salt concentrations. When the virus loses this outer layer it also loses its infectivity, but at the same time the enzyme activity, which had been sought for so long, is activated. With these activated, treated virus particles it is now possible to synthesise messenger RNA. The result is that one of the most important steps in the multiplication cycle of the virus can now be studied under perfectly controlled conditions.

Studies on the pathogenesis of bluetongue

B.H.K. 21/C13 tissue culture cells are used for the detection and titration of BT virus in tissues of experimentally infected sheep. The sensitivity of these tissue culture cells and of sheep to a certain type of BT virus was compared. It was found that tissue culture cells and sheep showed equal sensitivity in the quantitative estimation of virus content.

From the preliminary results it appears that when sheep are inoculated subcutaneously with a certain

amount of BT type 10 virus, the first sites of virus replication are the regional lymph nodes, the spleen and the lungs. Virus was detected in the above organs on the 6th day post inoculation and thereafter. It appears that viraemia becomes detectable only after virus replication has taken place at the above-mentioned sites.

The direct and indirect fluorescent antibody technique was applied using virus cultivated in tissue culture.

Horsesickness

In 4 of the 7 Veterinary Regions only a limited number of outbreaks were recorded, but the Eastern Transvaal, O.F.S. and Transvaal Regions experienced serious outbreaks. Severe losses occurred throughout the Eastern Transvaal and in the Johannesburg – Pretoria area, while in the Kimberley – Vryburg area many cases were seen in vaccinated horses and even 6-weeks-old foals.

In studies on the pathogenesis of African horsesickness (A.H.S.), infectivity titrations performed on specimens collected from horses that died following natural and artificial infection with A.H.S. virus revealed high virus titres in the lungs and in organs containing lymphoid tissue such as spleen, lymph nodes and pharyngeal mucosa. Only traces of virus were found in cardiac muscle, brain, spinal cord and bone marrow.

The results of other experiments indicated that natural horsesickness virus is composed of a mixture of virulent and avirulent virus particles. These could be separated by plaque selection in tissue culture as well as by the serial passage of either lung or spleen. The significance of these findings is that avirulent colonies of virus could be selected at relatively low passage levels for the purpose of vaccine production. Such vaccines promise to be safe and highly immunogenic.

Heartwater

In all the enzootic heartwater areas the disease took its usual toll, especially where owners relaxed their vigilance or did not take adequate precautionary measures.

In connection with research on this disease, Onderstepoort reports as follows:

Heartwater in mice

Up to the present a strain of *Cowdria ruminantium* from a goat and isolated in mice, has been passaged 74 times in mice. The pathogenicity for mice has remained unchanged and the organism still kills 100 per cent of mice. When infected material from mice is inoculated into susceptible sheep and cattle, the sheep invariably become ill, with high temperature reactions and about

10 per cent of deaths occur. It appears that the mouse adapted strain becomes more virulent for sheep as it is passaged through sheep.

In cattle the mouse adapted strain causes a slight temperature reaction only in some younger animals and a promising immunity develops against a virulent strain.

In view of the above findings investigations are now continuing on the possibility of using this mouse adapted strain for the immunisation of sheep and cattle.

In the meantime extensive investigations with the mouse adapted strain are continuing, in respect of its viability at various temperatures, the mechanism of immunity and its pathogenesis in mice. These investigations might ultimately contribute towards the solution of various problems with this disease in stock.

Heartwater in other small laboratory animals

The mouse adapted strain of *C. ruminantium* was also injected intraperitoneally into rats, hamsters and guinea pigs. In hamsters three out of six died with typical lesions of heartwater. Rats and guinea pigs showed no reaction whatsoever, but subinoculation of liver and spleen material, taken from them 30 days after infection, into mice resulted in typical symptoms and death in the latter.

C. ruminantium and tissue culture

Attempts have been made to grow this organism on a culture of line cells from the mosquito, *Aedes albopictus*, and on a culture of mouse peritoneal macrophages. It was found that the parasite did grow in both cultures, as its presence was demonstrated microscopically in culture smears, and the intravenous administration of cultures into susceptible sheep gave a temperature reaction and partial immunity in most cases. The growth was, however, poor and the parasite attenuated or altered to such an extent that the disease could not be produced by subinoculation, while the immune response was poor.

Ephemeral fever

With the exception of the Eastern Cape and Winter Rainfall Regions, three day stiffness appeared widespread. In some instances the percentage of cattle affected in a herd was high, but no serious losses were sustained as a result of mortalities.

Preliminary investigations reveal that ephemeral fever (E.F.) in dairy cows is of far greater economic importance than hitherto suspected, as the following findings indicate. There is a severe loss of milk yield, which to some extent is dependent upon the stage of lactation. Cellular reaction in the udder causes an increase in leucocyte content of the milk, which may

lead to discarding of the milk due to hygienic considerations. There are indications that the disease predisposes to udder infections. Pregnant cows tend to abort or give birth to weak or dead calves.

The investigations aimed at the development of an effective vaccine against E.F. have been completed. A low passage level of E.F. virus inoculated in conjunction with incomplete Freund's adjuvant induced the highest level of immunity and most durable immunity in cattle. Large-scale production of this vaccine has commenced and it should soon be available for distribution to farmers.

Rift Valley fever and Wesselsbron disease

No cases of these two diseases were reported. It is of interest to note that in a survey by the South African Institute for Medical Research, 14 per cent of 272 blood specimens from bovines collected in the Port Shepstone coastal area proved positive for Rift Valley fever and 21 per cent for Wesselsbron disease, although no cases of these diseases have ever been observed on the Natal South Coast.

Investigations are continuing at the Institute into the improvement of the RVF vaccine in cattle. Various attenuated strains have been evaluated and the possible addition of an adjuvant has been studied. There would appear to be a considerable difference in the immune response of cattle as against sheep to this particular attenuated strain in which species the vaccine has proved very effective in the past. The incorporation of an adjuvant did not increase the immunogenicity of this strain in cattle and investigations to find a less attenuated strain which is immunogenic yet safe are proceeding.

"Snotsiekte"

Two outbreaks of bovine malignant catarrh were confirmed in each of the Natal and Eastern Transvaal Regions and one in the Highveld. In all instances there had been contact between cattle and wildebeest.

"Jaagsiekte"

According to the report from Natal, fewer cases occurred in East Griqualand, where a high incidence was recorded during the previous year. This is ascribed to the mild winter. Only one other outbreak was reported, from the Bethlehem district in the Highveld Region.

During the past year a project was commenced at Onderstepoort for the purpose of finding the cause of jaagsiekte in sheep. The occurrence of the disease in certain flocks and on certain farms has long since supported the suspicion that the condition is infectious. No causal organism has as yet been isolated. Transmission of the disease by means of cell-free and

bacteria-free filtrates has been accomplished in overseas countries. It is therefore generally accepted that a virus is probably the cause.

As no virus could as yet be isolated, it is probable that a so-called latent virus is involved, similar to that causing blood cancer in animals. These viruses can only be isolated after induction, i.e. after their multiplication has been stimulated artificially by means of irradiation, chemical treatment or helper viruses. In order to obtain this, one should in the first instance have cell cultures containing the latent virus genome. Cultures of cells from jaagsiekte lungs have therefore been made. Promising results have been obtained and cell cultures can now be reproduced, showing colonies of transformed cells. Problems are still being encountered in keeping these cells alive.

Virus pneumonia of pigs

Isolated outbreaks of this disease were reported from the Vryburg area of the O.F.S. Region, while several unconfirmed cases were seen at meat inspection at a bacon factory in Estcourt.

Equine rhinopneumonitis

No cases of this disease were recorded.

Infectious ophthalmia

Reports from the O.F.S. Region indicate that because of the mechanical irritation caused by the seeds and blades of the grass stand which is particularly high, and the abundance of such transmitters as flies and other insects, this condition was prevalent in sheep. Cases where almost entire flocks were affected, were not uncommon.

A large number of outbreaks were recorded in the Calvinia area of the Winter Rainfall Region. Treatment of the condition was found to be of no avail unless measures to repel flies were simultaneously employed.

"Vuilbek"

Outbreaks of contagious pustular dermatitis — none of a very serious nature, and causing only slight losses — were recorded in one State Veterinary area in each of the O.F.S., Transvaal and Winter Rainfall Regions.

Infertility and venereal diseases

General

A large number of herds and flocks were examined during the year for infertility and low fertility. A common finding was that in many instances not infectious conditions, but functional sterility due to

insufficient nutrition, deficiencies and imbalances in rations and bad managerial practices, including lack of proper records, were responsible for breeding problems.

In one herd in Natal where the conception rate was poor and 90 per cent of the cows suffered from retained afterbirth, the condition was rapidly remedied by the addition of mono-sodium-phosphate to the ration. Poor conception was also encountered in cows on heavily fertilised (nitrogen) pastures, but the condition was rectified by the administration of Vitamin A.

Many cases of calcium, phosphorus, copper and manganese deficiencies or imbalances causing reproductive problems were reported from the Winter Rainfall Region, as well as a case of protein excess in the diet as a result of clover grazing corrected by the feeding of additional carbohydrate.

Two types of infectious epididymitis (*Brucella ovis* and *Actinobacillus seminis*) are known to occur in rams. Fluorescent antibody sera were produced at Onderstepoort against the two organisms and found to be highly specific. For technical reasons the sera could not be used directly on semen smears as a rapid diagnostic technique. The sera have, however, proved useful for the rapid identification of cultures made from semen.

Experiments were carried out to find a suitable method of infecting rams with *A. seminis*. The most successful method was direct intratesticular injection.

Two experimental vaccines were made. An oil emulsion vaccine of heat-killed organisms caused a good antibody response. A formalin-killed alum precipitated vaccine induced as much weaker antibody response. The immunity produced by the vaccines has not yet been tested because a suitable method of challenge has not been found, in spite of various methods.

The efficacy of Rev. I vaccine in protecting rams against *B. ovis* infection is being re-investigated, following a report in which 5 per cent infection was found in non-vaccinated flocks and 3,6 per cent in vaccinated flocks.

At the Institute studies on the distribution of mycoplasma and fungi in the genital tract and the pathogenesis of the condition in cattle were continued. Out of 1 225 sheath washings examined *Mycoplasma* species could be isolated from 255. Classification of these isolates has not yet been completed.

Only six out of 960 sheath washings from bulls examined for fungi, were positive. They all belonged to saprophytic groups.

Vibriosis

By subjecting 1 424 sheath washings and 1 044 cervical and vaginal mucus specimens to immuno-fluorescence and isolation methods, 71 *Vibrio fetus* infected bulls and 129 infected female animals were discovered at Onderstepoort. In addition 2 137 specimens were examined at Investigation Centres.

Vibriosis is widespread in the Republic, but is fortunately being stamped out in those areas where artificial insemination is used on a big scale. The disease is of greater significance where farms are not within reach of artificial insemination services.

Trichomoniasis

Only isolated cases of *Trichomonas* infection were diagnosed and then only in some of the Regions. The disease was of very slight significance.

From 1 376 sheath washings from bulls examined at Onderstepoort for *Trichomonas fetus* 112 were positive. The majority were from the Orange Free State. It was again proved necessary for sheath washings to be inoculated onto specific culture media, in addition to direct microscopic examination. Twenty out of the 112 positives could only be declared positive after culture examination.

IPV/IBR

Infectious *pustular vulvovaginitis* and infectious *bovine rhinotracheitis* has over the years been diagnosed in its IPV form in many parts of the Republic. The significance of the condition has not been proven beyond doubt as clinical manifestations are very seldom seen in herds in which infection has been established.

According to research workers the attenuation of IPV virus by serial passage in tissue culture was very disappointing on account of the very poor immunogenic responses obtained in cattle.

Subsequently, a low passage level of IPV virus was inactivated with formalin and adsorbed onto aluminium hydroxide. Intramuscular inoculation of this adjuvanted vaccine into cattle stimulated the development of a solid immunity against this virus. At present the optimal dosage and the duration of immunity are being investigated.

Chlamydiosis

As indicated in the Introduction the most important occurrence during the year was the appearance of enzootic abortion, which caused widespread extensive abortions practically throughout the sheep farming areas of the country. In infected flocks the disease was also responsible for the birth of a

very large percentage of weak lambs which died at an early stage from a variety of causes. In the absence of exact data losses cannot be accurately assessed, but estimates of losses as high as 90 per cent in affected flocks have been made with an average of 30 to 40 per cent.

Abortions and other losses in goats, cattle and horses were also recorded.

There appear to be grounds for suspecting that, although enzootic abortion was only diagnosed during the year, it has been present in the Republic in enzootic form for several years, and that conditions favourable for the disease led to the present explosive appearance.

The report of the Research Institute reads as follows:

Sheep — Very serious outbreaks of abortions occurred. Comprehensive investigations were carried out and *Chlamydia* organisms were identified in 85 per cent of the outbreaks. This finding was confirmed in most cases by positive *Chlamydia* serum titres and/or isolation of the organism.

Interesting lesions and syndromes are observed in lambs from flocks with abortions. These comprise pneumonia, loss of condition, affections of the brain and intestinal tract. *Chlamydia* are isolated from the affected animals.

Of the 101 outbreaks investigated *Vibrio fetus* organisms could only be isolated in two. These strains were of the OI sero-types which coincide with those occurring in cattle. In a further two outbreaks (in one of which *Chlamydia* was found) *Brucella* organisms were identified. Tests for *Mycoplasma*, *Toxoplasma*, *Listeria*, fungi, non specific bacterial and virus affections were negative.

Cattle — As in the case of sheep, comprehensive investigations of cattle for infectious causes of peri-natal mortalities were carried out. During the year 136 foetuses and still-born calves or calves which died shortly after birth, originating from 59 herds, were examined. In 14 of these outbreaks *Brucella abortus* was identified and in 5 cases *Vibrio fetus* sero-type OI was isolated. In 28 herds (47 per cent of outbreaks) *Chlamydia* was determined. Studies on the causes of abortion and the pathogenesis of *Chlamydia* in the adult animal, were commenced during the year and will probably be completed in the following year.

Horses and goats — From foetuses originating from three horse studs *Chlamydia* were isolated from two of these studs, while elementary bodies were demonstrated in placental tissue from the third one.

All the material received from two goat herds showed *Chlamydia* organisms.

Granular vaginitis

From Dundee in the Natal Region it is reported that granular vaginitis is widespread and is not very amenable to treatment.

Diseases of calves

White scours

As in previous years *Escherichia coli* infection caused serious losses throughout the country, especially in dairy herds where hygiene and management were not of a sufficiently high standard. Reports also indicate that on some farms strains of *E. coli* are involved against which the available vaccine does not offer any protection.

Paratyphoid

The prevalence of calf paratyphoid is declining, mainly as a result of the increased use being made of the highly efficacious vaccine, but also because of the improvement in calf hygiene. Sporadic outbreaks were, however, reported from all parts of the country.

Coccidiosis

Coccidiosis in calves was of little economic importance, as only isolated small-scale outbreaks, which rapidly responded to treatment, were recorded.

Calf diphtheria

Only one outbreak of this disease was recorded, namely from the Bethlehem area of the Highveld Region.

Sweating sickness

Sporadic cases were reported from the Mafeking area of the Highveld Region, the Mossel Bay area of the Winter Rainfall Region and all the enzootic areas of the Transvaal Region except Rustenburg, where the disease was widespread. The Vryheid and Nongoma areas of Natal experienced extensive outbreaks, involving also adult cattle. In the Eastern Transvaal the disease was prevalent. Some cases of sweating sickness were also seen along the Molopo River in the Vryburg area of the O.F.S. Region.

Onderstepoort states that no further strains of *Hyalomma truncatum* capable of producing sweating sickness have been isolated since 1953 when it was discovered that the progeny of a single female tick could cause this mysterious disease. For unknown reasons the

strain concerned lost its ability to produce the disease after 18 years of laboratory maintenance, during which time it went through 23 filial generations.

During the past year it has been possible to isolate a further 5 strains of *H. truncatum* which cause sweating sickness, from ticks collected in Zululand and the Uitenhage district.

Sweating sickness-producing strains were selected by feeding some of the adult progeny of single females on individual susceptible sheep and studying the ensuing reactions for typical symptoms.

From these observations it is clear that sweating sickness-producing *H. truncatum* ticks are not as rare and difficult to obtain as has been thought to be the case.

Virus pneumonia of calves

This condition was recorded in the Pietermaritzburg area of Natal, where 160 calves, housed in an intensive system in a calf rearing project, were lost.

Diseases of poultry

Infectious bronchitis

This condition is reported to be of great economic significance in the Natal, Transvaal and Winter Rainfall Regions, where it occurs widely. In Natal it is regarded as the main cause of a drop in egg production, and in the other two Regions as of major importance in broiler production.

The egg-attenuated I.B. Massachusetts vaccine is now being marketed and field trials confirm the preliminary experimental results, namely, that good immunity is conferred if only administered once at six weeks old, in areas where the natural infection at a later age gives a booster immunity.

An experiment is presently being conducted to compare the immunity in 40 000 broiler chicks conferred by eye droplet vaccination with that given in the drinking water. Results so far have shown that no untoward reactions occur. Experiments on broiler chicks, and modifications of vaccination programmes resulting from immunity studies, are continuing.

Infectious Coryza

Thirty isolates frozen in egg yolk were purified and freeze-dried at the Research Institute. These isolates originate from the following areas and species:

	Tvl.	Natal	Cape	O.F.S.	Overseas
Fowls	19	3	1	1	2

One isolate each was obtained from pigs, human beings, canaries and turkeys respectively.

Preparation of hyperimmune serum from the 2 overseas isolates has commenced. A bacterin has been prepared on a small scale from one of the local isolates. The vaccine was prepared in chicken broth. Aluminium hydroxide was used as an adjuvant.

Forty-five roosters were inoculated with the vaccine and groups of these were challenged at 3 weeks, 2 months and 4 months, respectively. Apparently a good immunity was conferred, when compared to the controls.

Large-scale vaccine trials are now being carried out on two farms. The bacterin is manufactured from organisms isolated on these two farms. Challenge results are not yet available.

Yields of organisms for vaccine production are being investigated on various media as well as the antigenicity of the organisms. Ten fowls were inoculated with chicken broth vaccine and ten with tryptose broth vaccine with aluminium hydroxide as adjuvant. The protection conferred after three weeks showed no difference between the two vaccines.

Mycoplasmosis

In order to study and evaluate the role played by *Mycoplasma* organisms in poultry pathology, it is essential that all isolates made are properly and accurately identified and typed. As research workers differ from one another regarding the grouping and classification of these types, it has been decided to commence this project from basic principles.

For this purpose type cultures have been requested from various research workers in the U.S.A. working on this subject. In addition cultures are being utilised which were available locally. From these cultures, single colonies have been isolated repeatedly by means of terminal dilution techniques to ensure the purity of the cultures and to study their colonial morphology.

From this it appears that, although in certain instances clearcut morphological differences exist, the colonial morphology in most cases gives no indication of the purity of the culture or the type to which the culture belongs. The presumably pure cultures were studied further to confirm their purity and to determine their basic characteristics.

The sterol (cholesterol) requirements, as essential growth factor, were established in order to determine which cultures belonged to the family of

Mycoplasmataceae and of Acholeplasmataceae; of 39 pure cultures examined so far, 38 belong to the genus *Mycoplasma* and one to the genus *Acholeplasma*.

Considerable problems are being encountered in grouping the S type (*M. synoviae*) with existing techniques, but further attempts with modified techniques are continuing.

Furthermore, the resistance of the organisms to unfavourable circumstances (temperature and chemicals) is being investigated, to serve as an additional basis for the purification of cultures and the classification. Promising results have been obtained and the work is progressing.

Cultural characteristics and serological techniques are also being studied. From 14 cultures tentatively regarded as pure, hyperimmune sera were produced in rabbits. With these sera 31 cultures were typed by means of the growth inhibition test and 17 with the metabolism inhibition test. From this it appears that the growth inhibition test yields very good results without cross-reaction between the different types. The metabolism inhibition test compares favourable with this, but in certain cases unexpected serological similarities do appear, the significance of which is still being investigated.

This work is showing good progress and should be largely completed during the coming year, thereby making type cultures locally available in order to characterise most of the poultry *Mycoplasma* types.

Fowl pox

The majority of the Regions reported only isolated outbreaks. Increasing use of the vaccine has reduced the status of this disease to one of no real significance. The 6 680 800 doses of vaccine issued during the year by Onderstepoort represent an increase of 981 800 over the issue for 1970/71.

Internal parasites

As a result of the high rainfall and other conditions favourable to internal parasites, economic losses due to this scourge were very high this year. This was especially the case in the Natal and Transvaal Regions, but the Highveld, O.F.S. and Winter Rainfall Regions were only slightly less affected.

In all the Regions tapeworms in young stock and roundworms played the biggest rôle; in the Highveld, Natal, Transvaal and Winter Rainfall Regions liver fluke was of great significance, while conical fluke created problems in the Highveld, O.F.S., Transvaal and Winter Rainfall areas; measles in cattle and pigs led to severe losses in Natal, the O.F.S. and Transvaal; nasal worm was

troublesome in Natal and Transvaal; in the O.F.S. the condemnation of livers because of liver tapeworm infestation caused serious economic losses.

In the course of surveys, and in diagnostic services to farmers, State Veterinarians throughout the country conducted post mortems and examined 37 583 faeces samples as an aid in solving problems of internal parasitism.

A survey was carried out to determine the incidence of nematodes in sheep at various times of the year on the Bethlehem Experimental Farm, in the Eastern Free State. Ewes and lambs were placed on natural pastures and 5 lambs slaughtered every four weeks. It was found that the wireworm *Haemonchus contortus* was prevalent during the wet season. Bankrupt worm *Trichostrongylus* spp. occurred throughout the year. Nodular worm, *Oesophagostomum columbianum*, increases from February onwards, overwinters in lambs and increases once more in spring. Whipworm *Trichuris ovis* and longnecked bankrupt worm *Nematodirus spathiger* occur sporadically. This information will undoubtedly lead to more effective control of helminthiasis in sheep in this Region.

At the Research Institute the method of testing anthelmintic efficacy in ruminants has been improved so that the results may be assessed by the non-parametric statistical method. In the case of equines, however, there is little or no information regarding the reliability of the various methods of evaluating anthelmintic efficacy. Moreover, such an evaluation is hampered by the difficulty of recovering relatively small nematodes from the vast mass of ingesta present in the caecum and colon of these animals.

The technique used to recover gastro-intestinal nematodes from ruminants in a modified Baermann apparatus in a waterbath was adapted to recover nematodes from a mule.

In a critical anthelmintic test the animals were treated and their faeces collected to determine the number of worms subsequently excreted. Finally the animals were slaughtered and the efficacy of the drug was based on the proportion of worms excreted to those remaining in the animal. In five donkeys this test gave excellent results for adult worms from the caecum and colon, but was unreliable with those in the stomach and small intestine as well as the larval stages in the caecum and colon because they were digested before expulsion.

Previous work at Onderstepoort has indicated that gut-tie in Merino and Karakul sheep may be due to nodular worm infestation. Peracute obstruction was caused artificially in Merino sheep to study the physiological effect of a total obstruction of the small

intestine. Preliminary observations show that the clinical signs accompanying such an obstruction are similar to those of gut-tie.

Reports have been received from various parts of the Transvaal that horses, particularly thoroughbreds, are often heavily parasitised with *Gastrodiscus aegyptiacus*. As its life cycle is not fully known effective control measures cannot be instituted.

Subsequent studies by research workers showed that both *Bulinus tropicus* and *Bulinus forskalli* may act as its vector. The former species is more common and widespread and is probably the main vector. It was found that the incubation period before the egg becomes infective to snails is dependent on the temperature. Snails begin shedding cercariae (i.e. the stage which is infective to equines) 55 days after infestation and eggs are found in the faeces of infected horses 95 days after infestation.

Existing remedies for the treatment of bilharzia in cattle are too expensive, generally difficult to use and dangerous to heavily infested animals.

During an outbreak in Northern Transvaal, infested cattle were treated during a period of 4 to 6 weeks with a relatively inexpensive organic phosphate worm remedy. The results are promising, as deaths ceased immediately after commencement of treatment and the worm burden decreased considerably as compared to untreated cattle. Further experiments under strictly controlled circumstances are however essential.

During studies on the longevity of the free-living infective larvae (cercariae) of the bilharzia parasite *Schistosoma mattheei*, it was found difficult to distinguish between live and dead larvae. A staining method was developed to make the identification of dead and live cercariae possible. This method is also useful in the evaluation of the quality of cercariae used in experiments.

Necropsy and histopathology has been carried out on 32 experimentally exposed cattle and on 14 naturally affected bovines.

Correlations have been made between duration of infestation, number of parasites recovered and pathological findings, and the pathology of chronic bovine bilharziasis has been described.

Major findings or conclusions thus far available are that the pathological changes present are thought to be dependent on the severity and duration of infestation rather than the number of exposures to cercariae.

Lesions involve all parts of the gastro-intestinal tract distal to the oesophagus, parts of the urinary system (kidneys, ureters and bladder), liver (consistently producing peri-portal fibrosis in chronic cases), most lymph nodes of the animal and the lungs in a large percentage of cases.

In sheep, measles, caused by the bladderworm of the dog tapeworm, *Taenia ovis*, have the same distribution as measles in beef and pork and it is hoped that this parasite may be used as a model for research on beef and pork measles. Previous work at the Institute has, however, shown that measles in sheep may degenerate when they are only 28 days old, thus indicating that they are probably not the normal host of this parasite.

When sheep are infested with these eggs many cysticerci develop but very few (7,2 per cent) are viable after 3 months. In contrast to this, few cysticerci develop in goats but the majority (87,8 per cent) are still viable after 3 months. It is therefore probable that goats or some ruminant other than domestic sheep, are the natural intermediate host of this tapeworm.

Trichinella spiralis is a nematode parasite of pigs, rodents and carnivores which is of great economic importance as it may also be transmitted to man via infested meat. In Africa, however, this parasite has been found only in wild animals, and in the Republic it appears to be limited to the Kruger National Park.

Experimental infestations showed that the multimammate rat, *Praomys (Mastomys) natalensis*, is more susceptible to the Kruger National Park strain of *T. spiralis* than are either white rats or white mice. In these rats a greater number of adults develop and they produce more larvae for a longer period than in other hosts. It was also found that male white mice are more susceptible than female white mice, but this has not yet been investigated in multimammate and white rats.

A total of 69 534 specimens from pig carcasses at abattoirs and 1 040 from wild animals in the Kruger National Park were examined for *T. spiralis* during the year and all found negative.

External parasites

As a result of the favourable climatic conditions ticks created serious problems all over the country. Lice in sheep were very troublesome in the Natal, Eastern Transvaal, O.F.S. and Transvaal Regions, with heavy infestations in Natal and the O.F.S. Cattle were also infected. Australian itch was a problem in the Natal and Winter Rainfall Regions. In parts of the northern Transvaal screw worm in cattle caused losses.

In the North-Western Cape areas of the O.F.S. Region sand tampan caused the usual losses, while along

the Orange River biting midges occurred in great numbers. Blowflies caused extensive damage in the Winter Rainfall Region. In the Kruger National Park mange was found to be a serious threat to lion and cheetah.

The investigation on resistance of South African ticks, particularly the genus *Boophilus*, to various dips was continued. *B. microplus*, the prevalent blue tick from Pondoland, received particular attention. This species, collected from nine dipping tank areas in Bantu reserves, was first multiplied at the Institute and thereafter fully tested in the laboratory. Two strains of *B. decoloratus* received from the Cape East were similarly tested.

The laboratory tests reveal that *B. microplus* from Pondoland is resistant to arsenic, fairly sensitive to the chlorinated hydrocarbons like BHC and DDT and very sensitive to the organic phosphates. On the other hand the Cape East strains of *B. decoloratus* are not only more resistant to arsenic and highly resistant to the chlorinated hydrocarbons, but also highly resistant to certain organic phosphates. These strains can only be controlled with certain other commercial organic phosphates.

These laboratory findings reflect the present situation in the above-mentioned areas regarding the effective application of certain dipping materials.

In those areas where *Boophilus* species are resistant to arsenic, but sensitive to the chlorinated hydrocarbons, these products are added to arsenical dips and generally used in cattle dipping tanks. Arsenic plus DDT is therefore the dip generally used especially in Pondoland and other Bantu areas. The withdrawal of BHC and DDT has made it urgently necessary to recommend a substitute. The obvious group of dipping materials is the organic phosphate group, which has not previously been used in the area and which, as indicated by laboratory tests, should be very effective.

The members of the organic phosphate group especially suitable as substitutes are those which can be used alone in the dipping tank i.e. without the addition of arsenic. In this way only one dip is used and arsenic is eliminated.

During the year 482 dip samples were received for analysis of strength.

The development at Onderstepoort of a mechanical apparatus for the collection of saliva from various species of ticks, has made it possible to collect relatively large amounts within a short period. Instead of 300 to 400 more than 5 000 ticks can now be handled per day. It was found that when the parasymphathetic stimulant pilocarpine, with dimethyl sulphoxide as

vehicle, was applied directly to the integument of both adult and larval ticks, this is rapidly absorbed and salivary secretion is effectively stimulated. The ticks are not harmed or damaged by this treatment.

This development makes it possible to study the biological and biochemical characteristics of tick saliva with a view to its rôle in the causation of tick toxicose and the transmission of infectious diseases.

During the year three new organic phosphate insecticides were tested in the laboratory against resistant strains of *Lucilia cuprina*. Of these only one appeared to give promising results.

Blowfly larvae, collected by the Division of Veterinary Services on farms in the vicinity of Riversdale, were received and tested for resistance. All these specimens proved to be resistant. Further collections from this area should give an indication of the distribution of resistant strains.

With field trials in the Riversdale-Albertinia area it was found that an organic phosphate gave adequate protection against blowfly attack for about six weeks. Thereafter attacks increased, but were limited in extent until the tenth week.

The filarial worm *Parafilaria bovicola* occurs under the skin of cattle in the Northern Transvaal and Northern South West Africa. It is responsible for haemorrhagic serous lesions resembling bruises which can result in the downgrading of carcasses and subsequent economic losses.

The female worm living in the tissues just under the skin, liberates her eggs and young stages of the worm in blood which oozes through a small aperture in the skin, and are taken up by an insect transmitter which feeds on this blood. The young stages of the worm's life cycle are completed in the insect which then transmits the infective stage to another animal. The object of the present study is to identify this insect and the transmission cycle.

The limited studies which have been possible to date suggest that bleeding in cattle occurs during the summer months and that carcass lesions are greatest during this period. The cessation of bleeding in winter can perhaps be coupled with lower mean temperatures. The life-cycle of this worm is unknown, but it is likely that worms survive the winter in their animal hosts and initiate new infestations the following spring, probably through flies.

The work is being continued.

OTHER VETERINARY RESEARCH

Basic research

African swine fever (A.S.F.)

A.S.F. virus has been isolated from an outbreak of disease in the Swakopmund district (S.W.A.). Electron microscopy has been successfully applied to confirm the diagnosis. A communication in this regard was sent to the O.I.E. meeting held in Paris in May 1972.

The survey to establish the presence of A.S.F. virus in tampons collected from the burrows used by wart-hogs has been initiated. To date 5 out of 16 burrows in the Waterberg district have been found to be infected.

Clostridium chauvoei: Blackquarter

The aim of research in this field is to improve the present vaccine and find a rapid method of measuring its potency. Following the finding that the bacterial cells are the most important portion of the vaccine, inducing immunity, various fractions were prepared from washed cells and tested in guinea pigs.

Neither extraction with distilled water nor citrate buffer produced a soluble extract with antigenic properties stronger than those of the residual sediment, although these extracts had a far higher haemolytic index. The cells were also broken up by means of ultrasonic vibration and the supernatant precipitated with polyethyleneglycol and ultracentrifuged. All the particulate fractions proved strongly immunogenic, while the soluble fractions were less so.

The most strongly antigenic fractions are at present being used to prepare hyperimmune serum in rabbits in an effort to determine their relative immunogenicity. They are also being used to sensitise red blood cells in comparative indirect haemagglutination tests in an endeavour to find a simple method for determining the potency of the vaccine.

Trials were run on the production of blackquarter vaccine in a large fermentor tank in order to minimise the labour involved in its manufacture. A method of production was eventually settled on and the vaccine is now being produced successfully in bulk.

Malignant oedema (Clostridium septicum)

Fluorescent antibody methods are now routinely used in the diagnosis of suspected gas gangrene. *Cl. septicum* was found in smears and then isolated in pure culture from cases of blackquarter in cattle at the Mara Research Station. These animals had been regularly inoculated with blackquarter vaccine. The pathogenesis

of the lesions may be related to small holes in the skin caused by a *Parafilaria* species. An experimental vaccine was produced and is being used with success.

Three outbreaks of gangrenous metritis following on partus or abortion in sheep and goats were diagnosed as *Cl. septicum* infection. The pathogenesis was probably related to crow-peck and lambing under unhygienic conditions.

A survey of post mortem smears using fluorescent antibody techniques is at present being undertaken to investigate the importance attached to finding *Cl. septicum* in post mortem material. The organism has been found in low concentration in a large percentage of cases, but in high concentration only in cases where the aetiology is suggestive of malignant oedema.

Clostridium oedematiens as a cause of sudden death in sheep and cattle

A survey of post mortem material by means of the fluorescent antibody technique has been undertaken in order to discover the relative importance that may be attached to finding *Cl. oedematiens* in post mortem material. The picture is far from clear as yet as the organism has been found in a wide range of species, and the concentration of the organisms on smears is related to the length of time between death and post mortem as well as to the disease found. More cases will have to be investigated in order to find a definite answer.

Caseous lymphadenitis of sheep

During the past year further work was undertaken in an attempt to find methods of preparing a more potent vaccine against *Corynebacterium pseudotuberculosis* infection.

Experiments were done in laboratory animals to determine whether the antibody response could be improved by non-specific stimulation. Guinea pigs were given *C. pseudotuberculosis* vaccine simultaneously with some other bacterial vaccines, but this did not lead to higher antibody levels.

Similarly, growing the bacteria in various media had no effect on their antigenicity. Altering the bacteria by ether-ethanol extraction or treatment with detergent also did not improve their antigenicity. It was also shown that sheep are not markedly more refractile to immunisation than other animals.

The effect of high doses of vaccine and immunisation of sheep with live vaccine is currently being investigated.

Escherichia coli has been a problem in the Republic for many years in calves, lambs and pigs, especially owing to the fact that there is a large number of strains which can only be differentiated by serotyping. Most strains are normal, non-pathogenic gut inhabitants, and the remainder are usually only pathogenic under certain conditions.

The production of O and K typing sera is now completed, and they are being used in routine diagnostic work. A survey has also been started to establish which serotypes are present in South Africa, how pathogenic these strains are, and which species of animals they most commonly affect. The *E. coli* vaccine issued by Onderstepoort contains 14 serotypes of international importance, and it is the aim of the survey to find the most common South African pathogens, so that they can be incorporated into the vaccine, to make the vaccine more effective under our conditions.

With regard to the problem of the poor keeping quality of the *E. coli* vaccine it was found that if the bacterial cells were washed in saline before being incorporated into the vaccine, the vaccine did not become toxic during storage. The *E. coli* vaccine is now again freely available.

In 15 cases the *E. coli* strain prevalent on a farm was not similar to the serotypes incorporated in the vaccine, and special vaccines were made in these cases.

Work has also started on determining the amount of cross-immunity between strains. Cultures with similar O and differing K antigens, as well as cultures with similar K but differing O antigens are being used in trials in mice. If a significant amount of cross-immunity is found to be present fewer strains will need to be incorporated into the vaccine, and the vaccinated animals can build up a better immunity to each strain present in the vaccine.

The incidence and distribution of mucosal disease (M.D.) in South Africa

A serological survey to determine the presence of antibodies against M.D. virus in bovine serum samples, originating from various parts of South Africa, has been completed. The results indicated that infection with M.D. virus is widely prevalent among cattle in South Africa.

Locally isolated strains of M.D. virus proved to be serologically closely related to the prototype Oregon C23V strain obtained from the United States of America.

Serological survey to establish the incidence of porcine enteroviruses responsible for reproductive failures

The serological survey has been continued. Porcine sera obtained from 20 farms were tested for antibodies to Smedi A, B and C viruses and the T80 virus as well. Four hundred neutralization tests were carried out. High levels of antibodies against the above-mentioned viruses are widespread. Of the sera tested, 22 per cent were positive to Smedi A, 16 per cent were positive to Smedi B, 28 per cent to Smedi C and 38 per cent to T80 viruses.

The indirect immuno fluorescent technique has been applied to the above-mentioned enteroviruses. It appears that there is a certain degree of cross-reaction amongst all of them

Mycoplasma infections in the genital tract of cattle

(a) Normal flora of the genital tract of cows

In view of the possible extension of the work on genital *Mycoplasmas* a survey was made in order to establish a quantitative criterion on the normal genital flora to be expected. Fourteen sets of genitalia were examined and cultures revealed mainly gram positive organisms.

(b) Typing of Mycoplasma isolates from the genital tracts of cattle

Mycoplasmas are often isolated at Onderstepoort from sheath washings of bulls and vaginal tampons from cows with reduced fertility. Overseas findings indicate a possible correlation between lowered fertility and *Mycoplasma* infection. Basic research in connection with *Mycoplasmas* of mammals is essential in order to compare the South African findings with those in other countries.

During the year 142 isolates were received from the Section of Reproduction at Onderstepoort. After primary isolation only 72 could be passaged. These were purified by cultural methods and passage. Serologically at least two types could be distinguished among the first 44 isolates. Techniques developed by foreign workers were utilised for further biochemical identification with little success. Strains obtained from the *Mycoplasma* Reference Laboratory in London will now be used to control all results.

Semen examination and fertility investigations

Fructose determinations are now carried out as a routine on nearly all semen samples processed. These levels are then related to the other semen characteristics and properties evaluated.

Rams exposed experimentally to *Actinobacillus seminis* were examined for fructose levels of ejaculated semen. Although all *non-reactors* showed a low fructose level, the significance of this observation is not clear at this stage.

Data evaluated from 42 samples collected from bulls by electrical stimulation, rectal massage, and artificial vagina have shown that only samples collected by means of A.V. can be relied on.

Mechanism of ovulation

The correlation of clinical data with assay of specimens is continuing. The total plasma protein (TPP) of 25 cows (14 progesterone treated, 8 untreated controls, and 3 ethyl oleate treated controls) has been completed. Progesterone treated cows show a marked variation in albumen:globulin ratio, with especially the β_2 fraction showing some interesting changes. The use of this phenomenon as a possible monitor for functional infertility problems is being looked into.

Production of "Teaser" cows by hormone treatment

Stilboestrol has been injected in 2 groups of cows. Use of a high dose of stilboestrol has been successful in producing good teaser animals. The incidence of bone fractures, however, has been alarmingly high which tends to detract from this method.

Hormone determination techniques

Good progress was made during the year with the determination of gonadotropins by means of radio-immunological techniques, progesterone determination with a protein fixation method developed at the Institute, while similar tests are being used for cortisol determination. Oestrogen analyses have also commenced. With improvements in existing techniques it will shortly be possible to explore the hitherto unknown aspects of fertility problems.

Mechanism of parturition

Twenty-five heavily pregnant cows were used in this experiment. Abortion was experimentally produced by means of cortisone treatment in 14 cases. The clinical manifestations were noted and material collected for laboratory assay.

The clinical pathology of the dam and her foetus were compared. Complete haematological examinations revealed a surprisingly close relationship between dam and foetus, with the exception of the total plasma protein and the albumen:globulin ratio. Foetal globulin is very low until colostrum has been taken in. Zinc and copper content are very high in foetal blood, while vitamin A levels are low until colostrum has been consumed.

Preservation of ram semen

It appears that excessive handling of the diluted semen is deleterious. On the other hand such semen withstands severe shaking surprisingly well. Karakul and Merino semen has been frozen in milk and in citrate buffer as diluents. The most promising results have been obtained with milk.

Work on this project is continuing.

Ultrastructure of spermatozoa

Work on three specific spermatozoan defects is now reaching finality.

A young Charolais bull showed a high percentage of proximal swellings of the midpiece. The stellate appearance on light microscopy made it difficult to decide whether the defect was a protoplasmic droplet or mitochondrial derangement. On electron microscopy it was shown that it was a cytoplasmic droplet and a favourable prognosis was given. The conception rate of the bull has subsequently been high.

Investigations are being carried out on loose heads in sperm and seminal tissue. Initial results have shown a distinct implantation groove defect.

A new *head-cap* defect of sperm in sterile Landrace rams has been demonstrated.

Rumen biochemistry

All research projects but one are concerned either directly or indirectly with the digestion of high fibre diets and the metabolism of the digestive end-products of these by sheep.

The aim has been to work out the physiological basis for the use of high fibre diets supplemented with non-protein-nitrogen compounds and fatty acids in the nutrition of ruminants. This should be of the greatest benefit to the Republic with its millions of sheep and cattle, and millions of tons of roughage produced annually in non-arable regions covering more than three-quarters of the land surface. Knowledge obtained from microbiological studies, including ecological surveys, and batch and continuous cultures *in vitro* has enabled the manipulation of the ruminal flora to provide the maximum production which ruminants can achieve on high fibre diets. This was done by encouraging the most effective fibre digesters to achieve their maximum growth potential.

A balance sheet of the rates of production of nutrients from the diet by such a ruminal flora functioning at maximum on the one hand and the rates at which these nutrients are utilised by the animal on the other, has indicated that high fibre diets are suitable for

maintenance or low production at best. This was found to be due to the inherent slowness of the microbial enzymatic digestion of the cellulose and hemicellulose components of the fibre.

Thus, where really high production is required as in the case of lactating cows and the finishing off of slaughter animals, it becomes necessary to feed a more rapidly fermented source of energy than fibre, such as starch present in grain or sugars in molasses. Thus one new project has been started to study the effect of the rate of change from a high fibre to a high maize-starch diet on the balance of the ruminal flora. At the same time studies are being carried out to determine the extent to which the maximum physiological production potential of the animal itself can be adequately supplied with nutrients produced by ruminal flora characteristic of high maize-starch diets.

Biochemical research

Phagocytosis of particulate antigen is important in the induction of antibody synthesis in the competent cell system. The phagocytic activity of cells could be accurately determined by means of dioxane extraction after incubation with latex particles. This method is dependent on the characteristic ultraviolet spectrum of latex in dioxane.

It was found that when the bluetongue virus was used as particle, the virus was adsorbed onto the cell membrane of non-phagocytic cells, but is also observed in the cytoplasm of active cells.

This part of the study has been completed.

The success with synthesis of antibodies against bluetongue formerly reported on, could not be satisfactorily repeated. On further investigation the bluetongue virus neutralising activity could be ascribed to the presence of bluetongue virus antibody in the serum of the medium and/or bluetongue infected mice which served as a source of peritoneal exudate cells. On occasion it has been found that bluetongue virus neutralising activity does occur in sera prepared from blood of mice from the Onderstepoort small animal colony. As a result of this uncertainty and the relatively weak antigenicity of bluetongue virus this work has been temporarily suspended.

Further work is now concentrated on sheep red blood cells as antigen. A sensitive titration method dependent on haemolytic plaque formation by individual active cells is used. An investigation has been commenced to determine the influence of steroid hormones, mainly cortisone, on the immune response. This work is of a provisional nature and includes a histological examination.

Progress is hampered by the wide variations encountered in normal mice. For instance, the spleen serves as a "barometer" of immunological activity of the animal and normal spleens of mice in the local colony vary from 50 to 300 mg. These variations hamper observations on the specific immunological reactions.

Geeldikkop

Research on geeldikkop is conducted in conjunction with the Plant Protection Research Institute and the Section of Agricultural Meteorology, Research Institute for Soil and Irrigation.

It is believed that geeldikkop is caused by a toxic fungus similar to that responsible for facial eczema.

Outbreaks of ovine photosensitivity were investigated in several ecological regions stretching from Underberg (Natal) in the north east, via Swinburne (Natal/Free State border) and Middelburg (Cape) to Stellenbosch in the south, and north through Calvinia (Western Cape) to Gamup, Richtersveld (N.W. Cape). The epizootiology and pathology of the disease was studied and the mycoflora of the disparate ecological regions was compared in the hope of finding a pattern that might throw light on the aetiology of geeldikkop.

A detailed survey was made of the changing mycoflora on a harvested wheatfield overgrown with *Panicum laevifolium* at Heilbron (Free State). The changes in mycoflora could be related to sensitive weather data recorded at a weather station erected on the farm. Unfortunately *Panicum* photosensitisation (dikoer) did not break out on the land and so the mycoflora and climate that precede an outbreak could not be determined.

Sensitive weather stations have been erected on eight farms stretching from Heilbron to the Stormsrivier. In addition existing rainfall and temperature data for the Karoo have been punched on cards for programming. The meteorological research aims at elucidation of the correlation between climate and occurrence of geeldikkop.

The pathology of Geeldikkop

The macroscopic, microscopic and ultramicroscopic pathology of geeldikkop in sheep have been intensively studied. The lesions produced in natural cases were found to be identical with those produced experimentally at Grootfontein (Middelburg, Cape) with *Tribulus*.

In the study of the various photosensitisation syndromes a few entities were encountered which do not fit into any of the known syndromes, for instance, a condition provisionally called "Kenhardt hepatitis", which requires further investigation.

Photosensitivity was created experimentally with the "vuursiekte" bush *Asaemia axillaris* which in the acute form produces reasonably characteristic changes in the liver, but in the experimentally produced chronic form would be difficult to diagnose. In the same way ganskweek *Lasiospermum bipinatum* can produce photosensitivity, which has not previously been described, and can cause confusion in the geeldikkop investigations.

Concerning the pathological findings in "geeldikkop" sheep, interesting lesions were found in the liver and kidneys. Those in the liver can essentially be described as varying degrees of bile duct proliferation and fibroplasia with pigmentation and a high incidence of a cholesterol-like, crystalloid material in the hepatocytes, Kupffer cells, bile ducts and interstitium. This material was sometimes so abundant that the bile ducts were completely blocked with it. In the kidneys varying degrees of pigmentation occurred, often to olive green, with uneven surface due to cystic dilatation of groups of tubules.

In this case also some showed crystalloid material similar to that in the liver. In all cases there was clinical evidence of a coronitis in due course resulting in "slipper" formation. In contrast with findings in cases of facial eczema, the urinary bladder was not affected.

In the few cases of facial eczema produced experimentally no cholesterol-like material could be demonstrated. These cases microscopically showed more than usually prominent lesions of the blood vessels, while the lesions in the urinary bladder were very conspicuous.

While geeldikkop and facial eczema can hardly be distinguished clinically, the pathology of the two conditions differ considerably.

The study continues and the indications at present are that the mycotoxin theory of its aetiology requires further intensive research. More cases of facial eczema will have to be produced for comparative purposes as well as cases of copper poisoning for comparison with enzootic icterus.

To date eight species of fungi isolated in the field during outbreaks of photosensitivity were grown at various temperatures on a variety of media and fed to sheep. The results were negative.

Lasiospermum bipinnatum and *Asaemia axillaris* ("vuursiekte" bush) poisoning that cause ovine hepatogenous photosensitivity in the Karoo have been experimentally reproduced and defined. It is now possible to diagnose the perplexing photosensitivity syndromes found there more accurately.

Histological examination of geeldikkop tissues revealed characteristic cholesterol-like crystalline deposits in especially the liver. These crystals differed from those found in other related conditions such as enzootic icterus as far as solubility in organic solvents was concerned. Thin layer chromatographic examination confirmed this difference and revealed that the crystals were not cholesterol, cholic-, taurocholic-, glycocholic- or deoxycholic-acid.

Interaction between organophosphates and diamidines

With further work on this phenomenon, reported on previously, it was found that organophosphate dips and anthelmintics act by selective depression of cholinesterase enzyme levels, viz this enzyme in external and internal parasites is inhibited much more severely than in the host animal.

It was conclusively proved in cattle that phenamidine (a diamidine babecide used for the treatment of redwater and biliary fever in domestic animals) has a synergistic effect on the cholinesterase inhibiting action of two commonly used and chemically different organophosphates — one an anthelmintic and the other a dip. Alone phenamidine has no apparent effect on cholinesterase, but a normal dose of phenamidine given in conjunction with a normal dose or concentration of an organophosphate anthelmintic or acaricide results in depression of cholinesterase values to lethal levels.

Another babecide of this group, Berenil, exhibited a similar tendency but the action was not as severe.

Electrocardiography in ruminants

For the purpose of studying the effect of cardiac glycosides occurring in poisonous plants the improved method of taking an electrocardiogram (ECG) in the sheep has now also been extended to goats and cattle and has been standardized and normal values for these two species have been established.

Gousiekte

Electrocardiographic (ECG) studies on sheep in the latent phase of this plant poisoning syndrome revealed that only slight time and amplitude changes are encountered but that a change in direction of the T-wave is a constant phenomenon. Inversion occurs within one to two weeks of dosing and usually remains so up to death. If the animal recovers, however, the T-wave reverts to normal in approximately 6 to 8 weeks.

"Krimpsiekte" (Cotyledonosis)

Toxicological studies were done on the active principle of *Cotyledon wallichii*. When given at high dosage rates this bufadienolide cardiac glycoside,

cotyledosid, produces the same electrocardiographic (ECG) changes in sheep that are produced by cardiac glycosides in general. However, when given at lower rates only dyspnoea is seen and ECG changes are secondary to the anoxia. At very low dosage rates given repeatedly, respiration is not affected, only minor cardiac conduction disturbances are noted but the typical neuromuscular weakness characteristic of krimp siekte is produced. As far as is known it is the first time that this peculiar neurotoxic syndrome is ascribed to a cardiac glycoside.

In guinea pigs it was found that the oral and subcutaneous LD₅₀ of cotyledosid was of the same order and that myocardial necrosis was constantly produced. On ECG examination an effect similar to that of other cardiac glycosides was found.

Anatomy

Cytogenetic studies are being applied to advantage on congenital deviations of the genital system of domestic animals. Resulting from the cases studied hitherto, it appears that admixture of blood, which occurs normally in bovine twins prenatally, can sometimes have an adverse effect also on the male member of a set of twins of different sexes, and not only on the female.

Continued studies of spastic paresis in bovines consist of a study of the muscle proteins and enzyme systems of the nervous system and pedigree patterns. These pedigree patterns are being studied in order to find an indication of the manner of its hereditary transmission. The symptomatology has been documented.

The study of the arterial circulation of the ruminant brain is for the time being limited to that of the cerebellum, on account of the extent of the investigation. Detailed surveys of 120 brains have already been carried out and documented. In this process a critical evaluation of the existing terminology of the arrangement of the cerebellum as well as of its arterial supply could be arrived at.

A study of the blood supply to the vertebral column of the bovine has been commenced. This may be of importance in the pathogenesis of posterior paralysis. The first phase, a study of all the foramina for the entry of blood vessels into the bone, is now in progress.

Pathogenesis of osteophytosis on the legs of horses

A radiological and histological investigation into the cause and development of new bone formation on the proximal sesamoids has been completed. It has been found that over-extension of the fetlock joint causes the tearing of various ligaments, which may be regarded as the main cause of osteophytosis on the legs of horses.

In a small percentage of cases osteophytosis can be caused by fractures of the sesamoids, arthritis of the fetlock joint, focal osteomyelitis and focal necrosis of the spongy bone. The latter is probably the direct result of disturbance of the blood supply to the sesamoid bone.

The development and growth of osteophytes are the result of a process of endochondral ossification.

Research on osteophytosis on other parts of the legs is continuing.

Miscellaneous research and projects

The registered projects in connection with which work was initiated or continued during the year, are listed below:

In vitro identification of *Cryptococcus farciminosus* — Grahamstown.

Actinobacillus seminis infection in sheep — Middelburg, Cape.

Control of tick-borne diseases by dipping at different intervals — Onderstepoort and Ixopo.

Evaluation of the parasitic status of livestock in the F Transvaal Lowveld with reference to the different farming methods practised — Barberton.

Some factors in the female tract influencing the success of artificial insemination in naturally cycling and oestrus synchronised ewes — Onderstepoort.

The ecology of the free-living stages of *Nematodirus spathiger*, Trichostrongylidae — Onderstepoort and Beaufort West.

Investigation of the seasonal incidence of internal parasites in sheep — Onderstepoort.

Illthrift — Albany and Bathurst districts. Incidence of the syndrome — Grahamstown.

Reproduction in the Cape buffalo *Syncerus caffer caffer* Sparrmann — Kruger National Park.

The drug immobilization of the buffalo *Syncerus caffer caffer* Sparrmann — Kruger National Park.

Coccidiosis of the Cape buffalo *Syncerus caffer caffer* Sparrmann — Onderstepoort and Kruger National Park.

Iodine deficiencies — Onderstepoort.

In addition to the above field trials were undertaken in the extermination of meercats on rabies-infected farms in the Ermelo and Piet Retief districts by the placing of poison pellets in meercat burrows, while on infected farms in the Rustenburg district, the large-scale poisoning of jackals with poison bait was investigated.

In collaboration with researchers at the Institute, 156 specimens of *Culicoides* midges, caught at Elsenburg and Tygershoek in the Western Province, as well as meteorological data, were sent to Onderstepoort.

Research on diseases of game

Survey of diseases and parasites of the Chacma baboon in the Kruger National Park

To follow up on the results in last year's report the usual 20 baboons (making a total of 100) were necropsied and studied. New findings include the following:

Toxoplasmosis — A diagnosis of toxoplasmosis was made on serological evidence in 11 baboons. Four of these also showed histopathological evidence (pseudocysts) of the disease in the heart, brain and skeletal muscles. Toxoplasmosis is an important disease in animals and man and therefore the baboon may provide an excellent experimental model for the study of this disease.

Muscular coccidiosis — Oocysts of the intestinal coccidia, *Isospora papionis*, were found in the skeletal muscle of three baboons. This finding may indicate that carnivores may play a role in the transmission of the disease, which would be an entirely new concept in the study of coccidiosis.

A heretofore unrecognized filarid parasite in the subcutis and intermuscular fascia. It has been placed in the genus *Dipetalonema*.

Anticerci of *Taenia crocutae* in the skeletal muscles. The definitive hosts for this tapeworm are the brown hyena *Hyaena brunnea* and spotted hyena *Crocuta crocuta*. This is the first report of these parasites being found in baboons.

A. histosoma mattheei in the mesenteric veins and mesenteric lymph nodes, and intestine. This finding becomes important when one exports these animals to areas free of Bilharziasis but where the snail vector exists. The baboons could then represent a source of infection unless adequate measures are used in sewage disposal at the laboratory housing these animals.

Important non-parasitic findings include:

1. **Capture myopathy** — This disease is of extreme importance in the study of wild animals since it represents an important cause of mortalities among captured game. Moreover, it is comparable to Meyer-Betz disease in man. Therefore it would appear that the free-living baboon would be a useful model for the study of this disease.
2. **Axonal hamartoma in the brain** — Developmental anomalies of the brain are rare in most animals and the finding of this lesion may be important in the study of similar defects in man.

General

Extensive capture and acclimatisation experiments have been conducted in the Kruger National Park with various drugs, while special attention was accorded to the prevention and treatment of overstraining disease, one of the most important mortality factors associated with game capture operations.

In the Western Province, investigations were conducted on the diseases and disease conditions to which game animals in that locality are prone. In the course of this work, 233 animals of various species were examined, and *inter alia* 84 faeces examinations done and analyses carried out of 114 liver, 48 urinary concretion and a large number of blood specimens.

Blood group studies

Cattle

Following the finding that meat extract differs in its chemical nature from one part of an animal to another and from one animal to another, an attempt was made to find similar differences in the enzymes responsible for the various body processes. It was consequently shown that there are not only differences in these enzymes, but in some cases absolute deficiency.

Investigations carried out on 564 animals of dairy herds showed that cows with lactoglobulin type AB had a greater resistance to mastitis than others.

A problem that has enjoyed the attention of many scientists, viz the origin and interrelationship of the indigenous cattle breeds, was brought closer to solution by an intensive investigation (3 356 specimens) into their haemoglobin types. Certain of these breeds viz the Zebu types possess a certain haemoglobin component that is peculiar to them exclusively and can thus become a valuable marker for identification of the influence of these cattle on other breeds.

New theories of cattle relationships and migrations can be brought forward which can assist colleagues from

the human sciences who are interested in the migration of human tribes because these tribes were invariably accompanied by their animals.

Horses

Further information was added to the present knowledge regarding the genetic differences between horses. A certain red blood cell enzyme (viz 6-PGD) shows a variety of types that can be used as a means of identification.

Pigs and goats

Investigations were carried out in regard to eight red blood cell enzymes in goats and three in pigs.

Although no difference between enzyme types in aborting and non-aborting Angora goats could be established the work will be continued with other enzyme systems.

Of the enzymes investigated in pigs, sorbitol dehydrogenase is the most important since it is involved directly in the sugar metabolism. The types found could be responsible for better metabolism and faster growth.

Wild Animals

Surveys were conducted on impala, elephant and blesbuck populations, the former two from the Kruger National Park and the latter from Rietvlei Nature Reserve, Pretoria. It was found that there is a large variety of genetic types among impala, and, to a lesser degree, among elephants. Although the blesbuck were shown by conventional methods to be homogeneous, it

was possible to illustrate variations by making use of serological reactions using goat blood grouping antisera.

These studies can be of practical use in the identification of wild animal populations and in the study of relationships between and within wild animal species.

VACCINE PRODUCTION

The number of vaccines produced by Onderstepoort has increased from 30 to 32 by the addition to the list of a vaccine against rabies in cats and one against infectious bronchitis in poultry.

The total number of doses of all vaccines issued during the year increased by almost 14 per cent from 112 506 383 to 128 171 316, which constitutes a record turnover. The increase is mainly due to the increased use of vaccines against Newcastle disease, fowl pox, lamb dysentery, anthrax, pasteurellosis and lungsickness and the introduction of infectious bronchitis vaccine for poultry.

Apart from the new vaccine against rabies in cats the demand for rabies vaccine for dogs more than doubled due to the increased incidence of the disease during the year. The increase in the use of brucellosis vaccine indicates the progress made with the brucellosis eradication scheme.

A list of issues of vaccines and diagnostic biological products over the past three years is given below.

Bacterial Vaccines	1969/70	1970/71	1971/72
Enterotoxaemia	36 355 800	31 977 050	30 923 350
Lamb dysentery	257 580	307 200	1 070 300
Lamsiekte (botulism)	4 553 270	4 381 600	3 887 185
Anthrax	11 559 590	11 424 300	12 222 430
Blackquarter	4 842 232	4 826 314	4 645 638
Swelled head of rams	6 600	8 150	24 400
Brucella (bovine)	844 277	1 175 500	1 447 605
Brucella (sheep)	352 600	436 650	421 350
Fowl typhoid	1 337 800	1 567 300	1 785 200
Calf paratyphoid	290 880	264 285	263 638
Tetanus	69 190	52 600	60 810
Corynebacterium pyogenes	145 700	161 520	209 960
Corynebacterium ovis	276 400	224 320	214 820
Pasteurella	402 420	345 160	481 880
Colibacillosis	9 220	25 410	14 940
Leptospirosis	—	90	2 352
Lungsickness	—	200 000	1 037 571
	61 303 459	57 377 449	58 713 429

Virus Vaccines	1969/70	1970/71	1971/72
Bluetongue	19 252 450	17 739 650	16 771 600
Fowl pox	5 154 000	5 699 000	6 680 800
Pigeon pox	459 200	653 000	684 300
Rabies (LEP for dogs)	197 730	268 136	437 475
Rabies (HEP for cats)	—	—	2 936
Lumpy skin disease	441 973	328 112	320 538
Horsesickness	110 526	126 573	128 240
Distemper (dogs and mink)	20 438	21 852	21 105
Infectious bronchitis	—	—	2 789 200
Newcastle disease	3 260 600	29 019 600	40 846 400
Rift Valley fever	3 540 850	296 970	105 790
Wesselsbron disease	1 148 650	410 710	181 450
	33 586 417	54 563 603	68 969 834
Other vaccines			
Heartwater blood	57 310	52 095	52 386
Anaplasmosis (gallsickness)	452 697	444 613	368 642
Redwater	70 200	68 623	67 025
	580 207	565 331	488 053
Grand total	95 470 083	112 506 383	128 171 316

Diagnostic antigens	Number of Units		
	1969/70	1970/71	1971/72
BWD antigen	47 360	37 290	34 755
Brucella ring test antigen	633	1 191	579
Mallein	70	110	10
Tuberculin (bovine)	686 550	411 830	679 670
Tuberculin (avian)	283 130	226 250	262 430

The following vaccines were produced by State Veterinarians in the field:

Anaplasmosis	46 081 doses
Redwater	14 731 doses
Heartwater	6 908 doses
Autogenous wart	5 325 doses
Contagious pustular dermatitis	5 437 doses

Brucella agglutination tests	60 017
Brucella milk ring tests	436
Vibriosis	2 137
Leptospirosis	5 488
Actinobacillus seminis	17 084
Antibiograms	703
Skin scrapings	304
Faeces examinations	37 583
Milk examinations (mastitis)	2 930
Semen	5 015
Haematological	14 924
Biochemical	17 489
Toxicological	602
Bacteriological	8 079
Virological	1 136
Biological	242
Histopathological	298
Trichinella examinations	70 574
Smear examinations	9 913
	254 954

OTHER VETERINARY SERVICES

Diagnostic services

In the course of diagnostic work, post-mortem examinations were conducted on a total of 3 466 cattle, sheep, goats, pigs, equines, dogs and other animals and 18 930 poultry by professional officers of the Division and on 3 315 poultry at the Research Institute.

At Investigation Centres the following laboratory examinations were carried out:

The examinations listed below were carried out at the Artificial Insemination Section of the Division at Onderstepoort and at the Research Institute:

	A.I. Section	Institute
Brucella abortus (serum)	746	11 515
Brucella abortus (semen)	178	
Brucella ovis (serum)		2 241
Vibriosis	498	788
Leptospirosis	521	2 354
IPV/IBR (serum)	236	
IPV/IBR (semen)	166	
Bacteriological (semen)	217	
Johne's disease		126
Rift Valley fever	41	
Sheath washings	5 492	
	8 095	17 024

Surveys

In conjunction with Onderstepoort a survey is being conducted in the Northern Transvaal to determine the incidence of *Parafilaria bovicola*. In the Soutpansberg district the incidence of *Culicoides* spp. is being determined.

In a survey of contagious abortion in bulls, oxen and non-immunised heifers in the Bantu areas in the Pietersburg State Veterinary area, 30 per cent of bulls and 46 per cent of oxen were found infected.

A large number of bone and liver specimens were collected for a comprehensive trace element and calcium and phosphorus survey in the Kruger National Park.

The survey to determine the mineral status of several domestic species in the Winter Rainfall Region was continued during the year.

In the Calvinia area the presence and prevalence of various internal and external parasites in different parts of the area were surveyed, in an effort to gain detailed knowledge in respect of parasites, for improved extension work amongst farmers.

Clinical services

As in the past in those areas where the services of private veterinary practitioners were not available State Veterinarians rendered clinical services when not prevented from doing so by their official duties. In addition, veterinary services were also provided for State-owned herds and flocks.

During the year R23 650,44 was collected for professional services, R7 384,23 for transport fees and R19 098,14 for vaccines sold by State Veterinary Offices, while laboratory fees amounted to R1 491,53, fees for meat inspection at export abattoirs to R40 618,96 and quarantine station fees to R4 653,89

Artificial insemination services

For the annual re-registration of bulls standing at the A.I. Co-operatives and individual breeders and the registration of new bulls intended for A.I. service, the A.I. and Reproduction Section of the Division examined 127 bulls during the year.

In view of the reliability of the fluorescent antibody plus culture test for vibriosis it was decided during the year to discontinue the heifer test for new bulls.

One A.I. Station bull, positive for IPV and with a high abnormal sperm count, was not recommended for re-registration, and was withdrawn from service. At the moment there are still 6 IPV positive bulls at A.I. Stations. These bulls are subject to regular semen examinations. No semen specimens from these bulls proved positive during the year.

As in previous years, a number of bulls with sperm abnormality counts higher than the statutory 20 per cent were conditionally re-registered. The bulls maintained entirely satisfactory conception rates.

During 1971 approximately 161 000 cows were inseminated in the Republic, compared to 144 000 in 1970. Of these, 128 000 were dairy animals and 33 000 beef cattle.

An unmistakable swing from insemination by inseminators to insemination by the owner or an employee has been noted. In the Transvaal, for instance, inseminations by registered inseminators decreased from 27 341 in 1970 to 23 984 in 1971, while total inseminations increased from 150 018 to 181 311 during the same period.

At Potchefstroom 14 cattle and 2 sheep A.I. courses were attended by 154 farmers who wished to apply A.I. in their own herds or flocks.

Three one-week courses, attended by 10 persons per course, were presented during May 1972 at Cedara (Pietermaritzburg).

A four-day course, attended by 10 persons, was arranged by the State Veterinarian at Barberton.

At Glen (Bloemfontein) two courses were held, during November 1971 and March 1972. The former was for students and the latter for farmers, and in both cases assistance was given by the A.I. Section.

Four courses, for prospective inseminators, were held at Onderstepoort. Of the 55 students attending, 52 qualified.

In addition to these four courses, the A.I. Section of the Division presented two A.I. courses for Bantu persons: in the first, held near Tolwe in the Potgietersrus district during February 1972, 7 of the 10 candidates passed; at the second, held in May 1972 near Perdekop in the Standerton district, 10 of the 15 candidates were successful. It is of interest to note that 80 per cent of the candidates were illiterate.

HEALTH SCHEMES

Bacillary white diarrhoea

Details of the tests performed and certificates issued during 1971/72 are tabulated below:

Region	Flocks	Tests		Certificates		
		Total	Fowls	Pos.	Susp.	Number of
						Holders
						Fowls
Cape East & Karoo	2	4 421	—	—	2	16 297
Highveld	13	48 659	10	—	12	195 612
Natal	15	436 637	—	—	15	436 637
O.F.S.	2	3 894	—	—	3	4 321
Transvaal	24	38 438	113	70	25	283 090
Winter Rainfall	29	270 133	—	14	29	899 900
Total	85	802 182	123	84	86	1 835 857

P.P.L.O. scheme

The data of tests performed is summarised below:

The take-over of the abattoirs within the controlled area by the Abattoir Commission has resulted in improvements being effected which will raise

Region	Fowls tested			Non-specific	Certificate holders	Tests non-certified flocks
	Total	Pos.	Susp.			
Highveld	4 392	25	—	—	6	—
Natal	5 597	—	—	11	8	59 429
O.F.S.	393	—	28	—	1	—
Transvaal	32 732	—	—	—	4	120 000
Winter Rainfall	46 915	1 166	108	762	32	—
Total	90 029	1 191	136	773	51	179 429

Pig recording and health scheme

The position remained virtually unchanged with an increase in membership from 38 to 42 during the year, but the number of pigs decreasing from 19 665 to 18 185.

standards of hygiene. Structural changes at the Germiston and Benoni Abattoirs are progressing as planned, while improvements at the Springs Abattoir are still in the planning stages.

FOOD HYGIENE

The results of the statement on marketing policy issued during the year, in terms of which important concessions were granted to private enterprise in the abattoir industry, were immediately felt.

This take-over also resulted in the Division assuming responsibility for meat inspection services at the abattoirs mentioned, by means of 12 Meat Inspectors, one State Veterinarian and one part-time veterinarian.

Certificates of Approval in respect of 42 new abattoirs or abattoirs that had undergone a change of

ownership were issued during the year, while 24 certificates were cancelled in respect of abattoirs that had closed down or changed ownership.

A poultry abattoir with a daily throughput of approximately 3 000 birds was erected, while one large and 4 smaller poultry abattoirs are in the planning stage.

State Veterinarians carried out 62 inspections at abattoirs and pointed out to owners defects and deficiencies in terms of the provisions of Act 87 of 1967.

During January 1972 an inspector of the Department of Agriculture, Food and Fisheries of the United Kingdom visited the Republic to inspect abattoirs and meat processing plants. As a result of his findings, all municipal abattoirs in the Republic were found unsuitable for export to the United Kingdom, while 6 meat processing plants, three of which run their own private abattoirs, retained their export licenses.

In South West Africa one municipal and two private abattoirs and three meat processing plants were approved for export to the United Kingdom.

Those concerned with the meat export trade have now realised that Western importing countries are only satisfied with the highest standards of hygiene in the handling of meat and meat products and efforts are being made to improve both premises and management.

The Meat Hygiene Section is fully aware that, in view of the ever increasing demands created by the expansion of the European Common Market, it will have to continue with advice and guidance to exporters to enable them to meet the required standards.

Rendering rough edible offal hygienically acceptable

Further studies were carried out at the Institute to determine the effect of hot pickling on ruminal offal. From these studies it appears possible to remove pathogenic, non-sporing bacteria from ruminal offal by hot pickling. However, the apparent ability of these as well as non-specific aerobic and anaerobic bacteria to survive and increase on previously pickled material, indicates the danger of post-pickling contamination by pathogens and poor keeping quality of such offal during storage.

Drug resistance and R-factors in Escherichia coli

The study was intended to provide information regarding the occurrence of R-factors in *E. coli*. These factors *inter alia* are responsible for single or multiple drug resistance and transfer thereof to sensitive organisms of the Enterobacteriaceae.

Antibiotics are used to promote growth and control stress and subclinical as well as clinical infections in farm animals, and there is a world-wide concern about the hazards which may result from extended use. Some of these hazards are inter-species transmission of bacteria, acquired bacterial drug resistance and contamination of food of animal origin with R-positive strains of bacteria.

Of *E. coli* 224 strains were isolated from apparently normal calves, diseased calves and pigs, raw meat and raw milk and examined. A high percentage of strains were resistant to either a single antibiotic or showed multiple drug resistance and many of these possessed R-factors. In calves the incidence varied from 100 per cent in animals from intensive units, exposed to antibiotics, down to 7 per cent in calves originating from ranches where exposure to antibiotics was minimal.

These results support findings in other countries i.e. that whereas simple non-transmissible drug resistance and the odd R⁺ organisms occur in bacterial populations not exposed to man-made antibiotics, their incidence rises dramatically where antibiotics are used in animal rearing programmes.

STOCK INSPECTION SERVICES

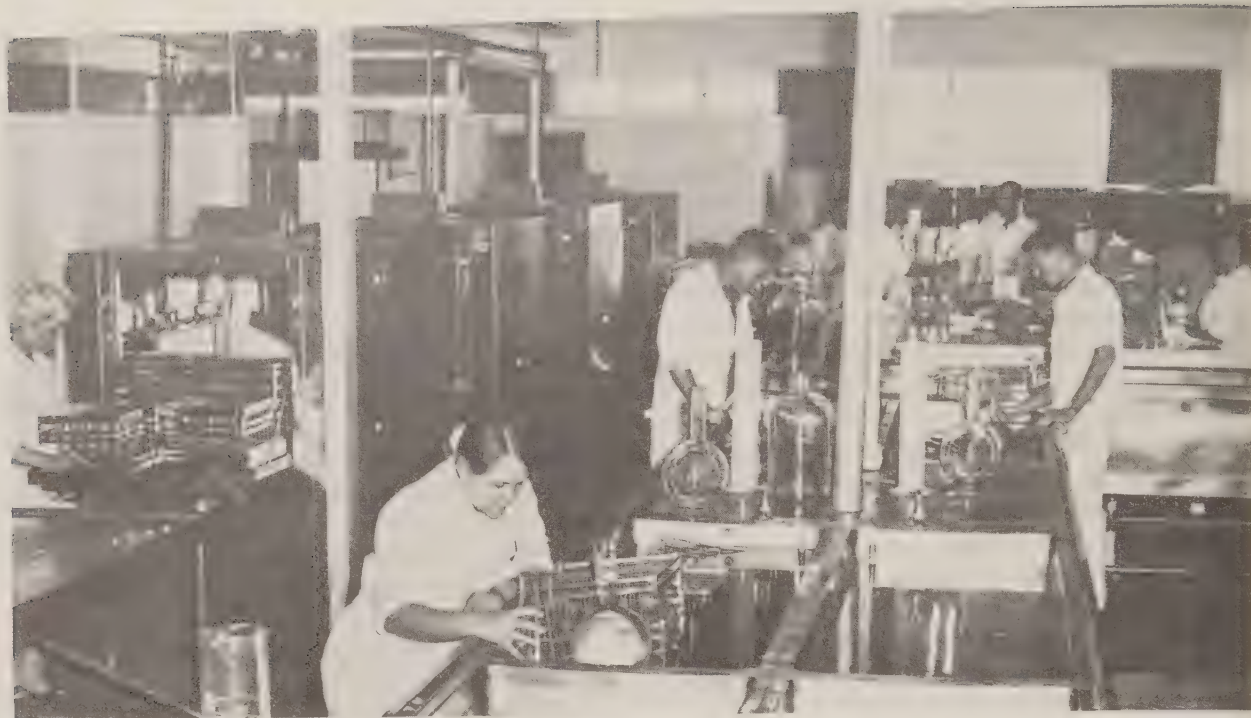
The foot and mouth disease infection in the Kruger National Park, throughout the year constituted an ever present threat to the adjacent stock farming areas, necessitating intensified short interval stock inspections, for which additional personnel had to be drafted into these areas.

Large numbers of the inspectorate staff were also for varying periods absent from their normal areas on other duties such as for instance campaigns in connection with outbreaks of Newcastle disease and sheep scab. All this led to a disruption of the normal stock inspection service of the Division.

In summarising it can be stated that the inspectorate branch of the Division, so absolutely indispensable for the protection of the welfare of the stock industry of the Republic, once again proved its flexibility and adaptability.

ANIMAL HEALTH EXTENSION SERVICE

Only the soundest stock farming practices are admissible. This is especially the case in our rapidly developing country with its swiftly expanding economy where there is a real danger that the demand for products of animal origin may outstrip the supply.



The cleaning of laboratory glassware in the new central washing establishment

Not only do the interests of the national economy demand scientifically based methods of animal husbandry, but also the economic welfare of the individual farmer. The financial losses in stock farming due to easily preventable causes are colossal and it is inconceivable that anybody aware of the facts could be complacent about the matter.

Being fully aware of the position the Division does everything in its power to convince stock owners of the advantages of utilising the accumulated mass of scientific knowledge available.

During the year articles were prepared for the rural press and national agricultural journals and Departmental publications; film shows of veterinary interest were presented, usually accompanied by explanatory lectures; pamphlets were drawn up; farmers' study groups were assisted by means of lectures and discussions; lectures covering a wide spectrum of subjects were delivered; by means of personal interviews valuable and very effective extension work was done.

During the year the animals listed below were imported for slaughter, farming or other purposes:

Cattle	11 725
Sheep	27 396
Goats	12 536
Pigs	22
Horses	238
Dogs	1 508
Cats	362
Birds	148 116
Primates	196
Mink	24
Wild animals	163
Tropical fish	1 286 597
Crocodiles	11
Rabbits	80
Frogs	24
Ticks	24
Insects	25

The table below gives an indication of the variety of products imported on permits issued by the Division:

IMPORT AND EXPORT CONTROL

Import

The control and regulation of the importation of animals, products and any other materials that could introduce animal diseases into the Republic, is one of the major functions of the Division of Veterinary Services.

Biltong	5 349 kg
Frozen meat	9 000 003 kg
	34 695 carcasses
	11 102 cartons
	6 620 bales
	725 cases
	20 packages

Cattle offal	3 trucks
Sausage casings	187 kg
	3 320 tierces
Cream	642 033 liter
Butter	53 924 cartons
Goose livers	50 kg
Hides and skins	943 249 kg
	9 674 bales
	950 192 units
Wet salted hides	281 874 kg
	1 509 bags
	4 197 units
Karakul pelts	24 002 units
Bone meal	2 886 t
Carcass meal	277 t
Hair and bristles	9 378 kg
	498 cases
Wool	583 570 kg
	10 691 bales
Rabbit fur	39 543 kg
Ostrich feathers	634 kg
Feathers	8 306 kg
	40 bales
Tallow	35 800 kg
	458 drums
Casein	1 205 kg
	4 686 bags
Elephant tusks	160 units
Processed skins and trophies	1 480 units
Mineral stock feed	560 bags
Second hand bags	508 533 units
	489 bales
Veterinary drugs	250 cartons
	40 drums
Trout eggs	755 000 units
Semen	559 amps.

Export

For export purposes, veterinary examination and certification in accordance with the requirements of importing countries were undertaken in respect of the following animals:

Cattle	9 091
Sheep	2 999
Goats	478
Pigs	3 850
Equines	598
Dogs	1 967
Cats	263
Birds	18 208
Poultry	1 395 439
Wild animals	134
Other animals	602
Reptiles	33
Fish	62
Frogs	50
Bats	12

The products listed below were certified for export:

Frozen and chilled meat	141 942 t
	8 537 cartons
Canned meat	6 320 t
Poultry meat	6 000 carcasses
Springbuck meat	10 carcasses
Bacon	180 213 kg
Whale meat	23 528 cartons
	2 113 packages
Whale meat extract	2 728 cases
	5 176 tins
Sausage casings	96 414 kg
Eggs	110 cases
Hides and skins	7 763 370 kg
	71 973 bales
	254 010 units
	43 936 pieces
	2 831 drums
Ostrich skins	614 kg
Karakul pelts	1 540 584 units
	57 bales
Horns and hooves	97 219 kg
	6 989 bags
	21 690 bales
Horn and hoof meal	80 000 kg
Blood and carcass meal	11 751 bags
Fish meal	173 425 kg
Whale protein meal	207 966 bags
Molasses meal	22 463 bags
Citrus meal	1 575 bags
Lucerne	2 t
Hair and bristles	19 752 kg
Wool	2 729 666 kg
	144 428 bales
Ostrich feathers	253 kg
Feathers	782 747 kg
Ox gall	32 t
Glue	15 600 kg
Egg shells	894 kg
Poultry feed	17 099 251 kg
	51 462 bags
Stock feed	289 t
	47 591 bags
Cotton seed meal	7 475 t
Oil cake meal	405 t
Bran	45 589 t
Processed skins and trophies	1 719 units
Ostrich egg shells	706 cases
Elephant skin	3 t
Ivory	10 917 kg
Lamb paunches	5 130 kg
Grains	134 575 t
Beans	11 072 kg
Peas	664 500 kg
Sweet corn	450 kg
Lupin seed	2 030 kg
Potatoes	3 942 t

Onions	2 800 bags
Dry flowers	225 kg
Musk melon	2 112 kg
Grapes	12 355 344 kg

Other veterinary training

At all the Agricultural Colleges, including the Bantu College at Fort Hare, State Veterinarians were, as in the past, responsible for the veterinary subjects for the diploma course.

At Fort Cox the veterinary course for Bantu Assistant Stock Inspectors was conducted by the State Veterinarian, East London.

TRAINING

Veterinarians

The activities concerning pre- and post-graduate education took a normal course during the year. An increasing number of foreign students apply particularly for pre-graduate study. During the past year more than 50 applications were received from the U.S.A.

Extension of the Faculty to accommodate 90 students per class remains an urgent necessity, as this will simultaneously make provision for certain facilities at the moment lacking in some departments.

The number of students registered for the 1972 academic year is:

B.V.Sc. II	46
B.V.Sc. III	48
B.V.Sc. IV	51
B.V.Sc. V	41
B.V.Sc. V $\frac{1}{2}$	3
M.Med.Vet.	46
D.V.Sc.	12
D.V.V.G.	4

Preparation of the lectures for the formal in-service training course for members of the stock inspectorate branch of the Division are nearing completion. Two State Veterinarians attached to the office of the Director of Veterinary Services are engaged on this all important task. These lectures are to be multiplied and will eventually be supplied to all stock inspectorate personnel prior to their attendance of the projected training courses, which will extend over a period of approximately one month. This training is intended to equip all staff members for more efficient performance of their duties.

The first course, for senior members of the personnel, will be held during September 1972 and will be repeated at intervals until all inspectorate personnel have received the necessary training.

LEGISLATION

Degrees awarded (September 1971 — March 1972):

M.Med.Vet.	2
D.V.Sc.	0
D.V.V.G.	0
B.V.Sc.	36

During the report year the following Government Notices were published under the Acts indicated:

Animal Diseases and Parasites Act (Act 13 of 1956)

- (a) G.N. R.444 dated 24.3.72 to repeal the regulations published in G.N. R.858 dated 28.5.71.

STOCK CENSUS

Region	Cattle*	Sheep		Goats	Horses	Donkeys and Mules	Pigs	Fowls	Dogs	Chin- chil- las
		Woolled	Non-woolled							
Cape East and Karoo Eastern	974 648	8 491 998	1 382 055	1 418 564	39 761	16 392	97 646	1 795 022	110 292	7 216
Transvaal	1 002 748	49 680	258 016	558 348	2 822	38 371	64 641	942 851	69 207	
Highveld	2 742 811	4 648 789	591 185	224 798	99 817	21 795	278 219	2 986 702	171 274	980
Natal	2 653 939	1 655 864	231 475	927 255	47 797	54 849	141 462	4 686 306	211 233	6 709
O.F.S.	1 294 583	2 971 332	3 707 870	682 750	56 650	46 438	94 320	890 956	73 010	3 881
Transvaal	2 159 973	1 827 946	431 620	498 382	37 873	36 015	292 708	9 355 754	158 305	
Winter Rainfall	316 759	2 520 044	860 780	375 097	22 325	11 144	134 721	4 921 771	91 998	2 415
Total	11 145 461	22 165 653	7 463 001	4 685 194	307 045	225 004	1 103 171	25 579 362	885 319	21 201

* Please refer to next table for analysis of cattle figures

Distribution of cattle

Region	White owners		Non-White owners	
	White areas	Non-White areas	White areas	Non-White areas
Cape East & Karoo	764 026	2 313	33 240	175 069
Eastern Transvaal	441 592	11 443	28 425	521 288
Highveld	2 423 820	1 798	180 228	136 965
Natal	1 119 976	577	274 655	1 258 731
O.F.S.	1 146 432	78	11 798	136 275
Transvaal	1 687 851	51 048	95 600	325 474
Winter Rainfall	314 251	216	585	1 707
Total	7 897 948	67 473	624 531	2 555 509

Animal Slaughter, Meat and Animal Products Hygiene Act (Act 87 of 1967)

- (a) G.N. R.2028 dated 12.11.71 to repeal G.N. R.3456 dated 3.10.69 and substitute different grounds for the exemption from the provision of Act 87 of 1967 of animals slaughtered by owners of land for private purposes.
- (b) G.N. R.935 dated 2.6.72 to amend G.N. R.2028 dated 12.11.71.

note that in the 10 year period 1962-72 a total area of 10 950 km² — including 5 250 km² on the Moçambique side of the Rhodesia-Moçambique border — has been freed of tsetse fly.

At the request of the respective Governments officials of the Division of Veterinary Services visited Rhodesia, Swaziland and Lesotho during the year for inspections of and consultations in connection with export abattoirs in these countries.

Liaison with overseas countries

Scientific visitors

During the course of the year 51 scientists from 19 different overseas countries visited the Institute for varying periods, to have discussions and obtain information, mainly on diseases peculiar to Africa.

Three visitors from Australia, two from West-Germany, one from the U.S.A. and one from Italy spent longer periods as guest workers at the Institute

Apart from the above 395 foreign tourists in organised groups visited the Institute.

Technical assistance and advice

Bluetongue World Reference Centre (O.I.E.)

Once again this Institute has been called upon to assist overseas countries in the diagnosis of bluetongue. This has entailed the continued preparation of reference antigens and anti-sera.

A sample of virus isolated from *Culicoides* in Nigeria would appear to represent a new immunological type. From Italy a consignment of 267 cattle sera were examined for evidence of previous infection by bluetongue virus. Investigations were completed on the typing of samples from Egypt.

In order to assist overseas countries to prepare vaccine in an emergency the first stages in the plague

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African Territories

Eight scientists from Botswana, Kenya and Moçambique visited the Institute during the year. Apart from the above, two persons from Moçambique are at the moment engaged on post-graduate study at the Institute and Faculty

The tick survey in Botswana, with which the Institute assisted, has been completed and a report for publication is being prepared jointly. This will give a comprehensive review of tick distribution in Botswana.

The following vaccines prepared by the Institute were supplied to African territories:

Angola	240 455 doses of 2 vaccines
Botswana	203 459 doses of 20 vaccines
Lesotho	215 020 doses of 7 vaccines
Malawi	692 200 doses of 12 vaccines
Mocambique	10 608 doses of 2 vaccines
Rhodesia	2 890 484 doses of 19 vaccines
Swaziland	618 337 doses of 20 vaccines
Zaire (Congo)	10 510 doses of 3 vaccines
Zambia	1 661 550 doses of 9 vaccines

Under "Trypanosomiasis" details were given of the joint Rhodesia — Angola — Moçambique — South Africa operations in tsetse fly eradication. It is of interest to

purification of attenuated antigens were completed. This task will eventually provide tested seed virus for the production of vaccine.

World Reference Centre for Horsesickness (O.I.E.)

No specimens were received from foreign countries for examination for horsesickness during the past year.

Vaccines supplied

The following vaccines, prepared by the Institute, were supplied to overseas countries during the year:

Bahrein	100 doses of 1 vaccine
Belgium	100 doses of 1 vaccine
Israel	5 500 doses of 1 vaccine
Mauritius	300 doses of 1 vaccine
St Helena	3 100 doses of 3 vaccines

International organisations

The Director of Veterinary Services, Dr P.R. Mansvelt, visited Paris during the period 13 to 22 May 1972 for the Annual Meeting of the Office International des Epizooties.

Study tours and official visits

In addition to organising and controlling the annual tsetse fly spraying operations which took place during the period 1.7.71 to 16.9.71 in Rhodesia and

Moçambique, and from 20.7.71 to 18.9.71 in the Eastern and Western Caprivi and Angola, Dr E.B. Kluge attended meetings of the Interterritorial Committee for the Control of Tsetse Flies and Trypanosomiasis in South East Africa with representatives of Rhodesia, Moçambique and South Africa at Lourenço Marques on 7.12.71, and at Salisbury on 10.4.72, and held discussions with the Botswana and Angola representatives on the Committee for the Caprivi Fly Complex at Pretoria on 22.3.73. The Lourenço Marques and Pretoria meetings were also attended by Drs M.C. Lambrechts and P.R. Mansvelt respectively.

During October 1971 Drs Lambrechts and J.P. van der Merwe attended the meetings of the Interterritorial Foot and Mouth Advisory Committee and the SARCCUS Animal Health Committee in Blantyre, Malawi.

At the request of their Governments, Dr C.W.A. Belonje visited Rhodesia during the period 19 to 22 July 1971 and Swaziland on 28 and 29 October 1971 to inspect their export abattoirs. On the Swaziland visit he was accompanied by Dr Mansvelt. On 4 and 5 May 1972 Dr Belonje inspected the Umtata Abattoir at the request of the Transkei Government.

Dr J.H. Huyser visited Maseru at the request of the Lesotho Government on 9 and 10 May 1972 for consultations with the Lesotho authorities on their proposed export abattoir.

8. Agricultural Engineering

Introduction

The need for greater efficiency in the agricultural industry and consequently also for more intensive engineering assistance has increased to a marked extent during the past year. This applies to extension in all the branches of agricultural engineering, not only for the farmer, but also for all other bodies that render agricultural engineering services to the agricultural industry.

Meaningful extension in the field of agricultural engineering requires purposeful and systematic test, surveys and research, and rapid and effective dissemination of the available information and knowledge. All attempts on the part of the Division to meet agricultural engineering requirements are accordingly aimed at making the most efficient use possible of the limited staff, as is clear from the Division's development programme, the official testing programme for agricultural equipment and the varied activities of the Division.

The first three reports on the testing of agricultural equipment were published during the year, viz the reports on single kernel planters, cattle scales and fertiliser spreaders. The testing programme is now in full swing and it is expected that at least six series of reports will be published every year.

Considerably more assistance and advice was given to other Departments and bodies, and there was also greater co-operation. Apart from the Regions and Institutes of the Department these bodies included the Departments of Forestry, Bantu Administration, Water Affairs and Agricultural Economics and Marketing, the Provincial Administrations, the Railways and various agricultural boards and co-operatives.

Testing of Agricultural machinery and equipment

The official testing programme was launched in 1969 and during the past year the first three series of reports were published in *Farming in South Africa* viz:

Single-kernel planters: Report nos. 7101 – 7107;
8 Cattle scales: Report nos. 7201 – 7208;
6 Fertilizer spreaders: Report nos. 7209 – 7214.

Three milk production meters were also tested and a confidential report was submitted to the Animal and Dairy Science Research Institute and to the three firms which had submitted the meters for testing.

An introductory article, which should be of great value as an extension document, was included with each series of reports.

Experience has proved that it takes at least a year to launch an implement testing project through all its different phases, including publication, but the period could be much longer. The impact of the reports was for-reading and in certain respects surpassed expectations, especially with regard to the favourable response from the firms concerned.

The implements on which test reports should be published during the next year are the following:

Mouldboard ploughs, milking machines, hammer mills, disc ploughs, sub-soilers, chisel ploughs and disc harrows.

Preliminary work has commenced on the following product groups, which will be submitted to tests in the near future:

Pick-up balers, combine harvesters, grain drills, pest control implements and sprinkler irrigation equipment.

A.C.T.A.E.E.

The Advisory Committee for the Testing of Agricultural Engineering Equipment held four meetings during the year and contributed greatly to the success achieved with the official testing programme. Apart from assisting with the determination of priorities and the formulation of policy, the members of this committee made directive recommendations with regard to test procedures. Furthermore, owing to the close contact of committee members with the trade, the Division benefited greatly in obtaining the necessary co-operation from the various manufacturers.

Soil Conservation Works

The subdivision responsible for the design and construction of soil conservation works operating mainly in the upper catchment area of the Orange River generally maintained a high level of production and showed progress in some branches of its work.



The performance of a four-row planter being tested in the field

The statistics in the following tables indicate the work done by the design and construction sections:

Summary of work done by design section

Type of Work	Number
Detail surveys of conservation work sites completed	22
Detail designs of State conservation works completed	12
Detail foundation examination for the construction of State works	16

Works under construction and completed

Year	Under construction		Completed	
	Number	Value (R)	Number	Value (R)
1971/72	9	388 191	9	401 071
1970/71	8	275 497	5	419 120

Repair works under construction and completed

Year	Under construction		Completed	
	Number	Value (R)	Number	Value (R)
1971/72	2	47 300	9	115 979
1970/71	4		6	

Production of materials and excavation works carried out

Type of work done	1971/72	1970/71
Rock crushed m ³	14 474	13 553
Building sand quarried m ³	9 404	5 624
Concrete cast m ³	17 655	18 195
Earth excavations m ³	95 742	102 813
Rock excavations m ³	2 946	5 962
Stone purchased and transported m ³	2 393	
Earth moved (repair work) m ³	163 964	126 344
Gravel transported and spread (repair works) m ³	23 685	8 101

Material testing laboratory

Although this laboratory at Aliwal North is not yet fully equipped, the testing of materials has now been placed on a more organised footing: Possible borrow pits are identified during a general inspection, factors such as soil type, distance from site and potential danger of erosion of borrow pit after completion of work are taken into account, soil samples taken from the borrow pit are tested for suitability and the necessary construction methods communicated to the construction units.

Agreement has been reached with the Research Institute for Soil and Irrigation to include mechanical

A soil conservation structure under construction in the Broekspruit catchment area in the Burgersdorp district



analysis in soil classification programmes. In this way a data bank showing uniform agricultural and mechanical properties for different soil forms and series would be built up.

Soil conservation research

The soil conservation research of the Division, conducted by the research team at Aliwal North, did not extend beyond the selected badly eroded areas in the Upper Orange River catchment area where the 4 registered projects and 17 pilot experiments are located. The work is aimed mainly at the reclamation and stabilization of dongas and other badly eroded areas.

From the research results obtained so far the following deductions can be made with regard to factors influencing plant growth in dongas:

- All trees in water courses should be removed.
- Old plant growth should be removed regularly — preferably moved or cut rather than grazed.
- Surfaces of sediment deposits become less and less pervious and should therefore, be loosened from time to time, to a depth of at least 60 cm.
- A marked improvement in the plant growth on eroded areas was generally obtained by placing reed mulches on these areas.
- Mechanical loosening of bare patches encouraged plant growth, especially when the checkerboard subsoiler or the ordinary plough was used.

- Propagating Spanish reed from culms is easier than planting rhizomes, but rhizomes were more successful. When Spanish reed culms are used the conditions must be favourable as regards deep wet sediment and planting must be done no later than early summer.

- Common reed grew extremely well.
- Losses of newly-planted material as a result of floods were not a serious problem.
- The latest findings with regard to sediment gradients and sediment depositions above the 33 soil conservation works studied for the past 20 years, clearly stress the importance of establishing vegetation above soil conservation works and having good control as far as grazing is concerned. It emerges that the gradients attained for catchments well cared for are roughly twice the mean gradient, whereas the gradients attained for the most neglected catchments are about half the mean.

Farm buildings and structures

During the year under review there was a sustained increase in the interest in this side of the Division's work, and in the work itself. In co-operation with regional engineers and interested bodies, this section concentrates on —

- low-cost building methods;
- low-cost building materials;

- prefabrication techniques for fast and easy construction;
- the use as far as it is economically justified, of labour-saving techniques, equipment and systems;
- close co-operation with all interested bodies, including Divisions and Institutes in the Department, the Regions, agricultural control boards, provincial education departments and the National Building Research Institute of the C.S.I.R.

In view of the present requirements in respect of farm buildings and structures, most of the time was spent on housing for pigs and dairy cattle, but attention was also given to housing for calves, beef-cattle handling facilities, bulk handling facilities for grain and studies on the treatment of animal offal.

The following are some of the results achieved:

- The sow pen with standing room for 18 designed at the Animal and Dairy Science Research Institute at Irene is a cheap industrialised building with a labour-saving slated dung floor; the pen has great economic advantages and is arousing widespread interest. A similar farrowing pen is also under construction and a fattening pen, designed on the same principles, will be built later.
- Because of the special care that calves require during the first eight weeks especially on dairy farms, a study of existing systems of calf housing was undertaken. This led to the design of a simple calf crate for two calves that the farmer can construct himself; the crate costs about R4 per calf.
- Outstanding results are being obtained with a new layout for cattlehandling pens developed by the section.
- One of the features of the intensive fattening pens for 2 500 sheep completed at the Nooitgedacht Research Station is a unique sorting unit which enables one labourer to sort the sheep into six different pens.

Water utilization and drainage

The Subdivision for Irrigation and Drainage and the Regional Engineers rendered extensive services with regard to irrigation, drainage and stock watering.

Study tours: Three engineers undertook study tours which included visits to the U.S.A., France and Italy to study different aspects of irrigation development, irrigation research and the testing of irrigation equipment.

Developing farms on irrigation schemes: The development of farms on large irrigation schemes, previously undertaken by the Department of Agricultural Credit and Land Tenure, was allocated to the Division in April 1970. During the year under review much time was spent on the planning of development schemes at Makatini, Van der Kloof and the Fish-River areas. The construction of a pilot development scheme at Makatini was begun.

The following table gives an indication of the type of work done, rate of production per machine-hour and the unit costs:

Type of job	Production	Rate (machine-hours)
1. Cleaning grid lines	141 km	0,20 km/mh
2. Primary bush clearing	1 141 ha	045 ha/mh
3. Final bush clearing	200 ha	2,00 ha/mh
4. Ripping cleared areas	80 ha	0,20 ha/mh
5. Heavy discing	60 ha	0,50 ha/mh
6. Levelling of grid lines	121 km	8 km/man-day
7. Topographical survey, balancing of tachco-meter books and drawing of plans	1 141 ha	75 ha/man-day

Flood irrigation research

A flood irrigation research project was started and a procedure was developed to determine the stream size and cut-off time for flood irrigation beds on different slopes and on soils with different intake rates.

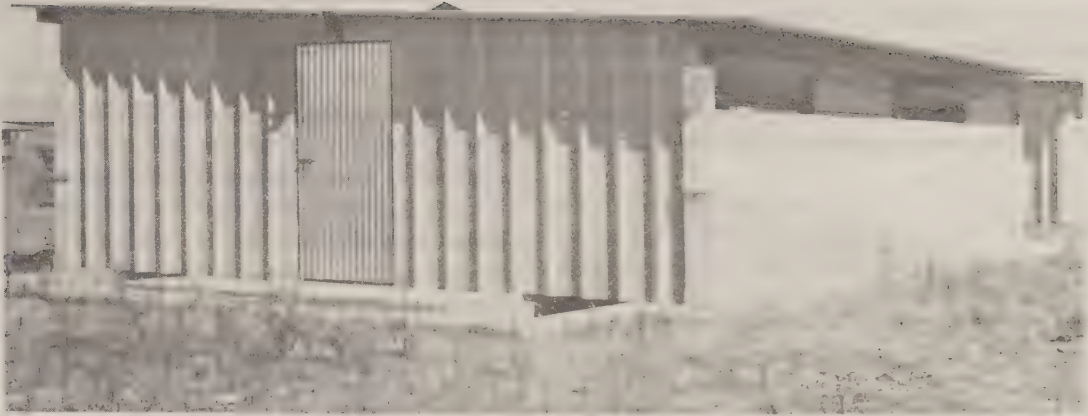
Guide for water requirements

One of the Principal Engineers of the Division played a major role in compiling a guide for the estimation of the water requirements of crops under different climatic conditions in the Republic.

Hydraulic laboratory and testing

As the testing of irrigation equipment is included in the official programme for the testing of agricultural implements and equipment, a hydraulic laboratory was constructed and the required testing apparatus for the testing of sprinkler irrigation equipment was developed and built.

The tests to be conducted include a durability test on the various sprinklers. The distribution pattern of sprinklers will be determined before and after a 1 500 hours continuous working period. Centrifugal pumps, pipes and pipe couplings are also to be tested in the near future.



New pig-houses at the Animal and Dairy Science Research Institute, Irene, designed by the Division of Agricultural Engineering. The pig-houses are of a simple design, are completely prefabricated and are cheap



Interior of the pig-houses: dry sows in steel crates on a plank-mat through which droppings and urine land in a channel underneath the floor. Good results are being obtained with this design and the industry is already using it extensively

Professional and technical services

The Division rendered extensive professional and technical services to the Regions, the Research Institute and other Departmental bodies, as well as to other Departments. Regional and other engineering staff played a leading role in the planning and construction or installation of building works, water supply and irrigation schemes and the drawing up of specifications for, and purchase of farm and other machinery.

In numerous cases assistance was also rendered in connection with various other aspects of research station development, such as the surveying of building sites, camp systems and conservation works.

The nature and extent of this service is evident from the following:

Glass-houses and growth chambers

The Division is responsible for budgeting, planning and drawing up plans and specifications for, and supervising the construction of all Departmental glass-houses.

Two glass-houses 6 growth cabinets and an incubator (total cost R102 505) were completed during the 1971/72 financial year.

During the same period the construction of three glass-houses, 2 shade structures and 2 growth cabinets was undertaken and/or completed and existing units were modified. The total cost of this work was R177 968.

The new evaporative cooling system designed during the previous year was installed at the glass-house at Döhne, Eastern Cape Region.

The underfloor air distribution system installed at the Research Institute for Citrus and Subtropical Fruit at Nelspruit was brought into operation and so far the system is functioning efficiently.

The number of persons advised on glass-house construction increased considerably. Requests for assistance came from various institutions and for different purposes. Some of the enquiries handled came from the following:

- The Rand Afrikaans University, on advice on research glass-houses
- The Department of Public Works, on different types of glass-house
- Large nursery in Pretoria on a R750 000 improvement project

Well-known Agricultural firm, on a glass-house for research work

A number of people were advised on a small type of glass-house for the gardener

Scheme for bulk storage and handling of grain

Two Principal Engineers of the Division act as technical advisers to the grain silo committee of the Department of Agricultural Economics and Marketing. The function of this committee is to allocate the R8 million annually provided by the Land Bank for bulk storage projects. Among other duties the technical advisers inspect the sites of proposed projects, advise the committee on technical details and costs as well as on future projects and carry out regular inspections during the course of construction.

The total value of loans granted by the Land Bank to co-operatives up to 31 December 1971 was more than R50 million, approximately R38 million of which has been paid out already. A summary of the projects is given in the following table:

Projects	Number of projects	Capacity	
		Bags	m ³
Completed	51	9 269 000	1 094 500
In operation but not completed (30/4/72)	58	18 000 000	2 125 500
Under construction (30/4/72)	6		
Total	115	27 000 000	3 000 000

Farm machinery and implements

The Professional and Technical Services Section and the Regional Engineers rendered extensive services to Regions and other Departmental institutions, taking a leading part in most of the mechanisation activities at the different centres. This included the planning of mechanisation systems, tractor and implement record systems and maintenance procedures and measures.

At the Divisions head office specifications were drafted, checked and recommended for a total of approximately 180 machines and implements valued at about R190 000.

Hydrographic planning

The already recognised principle of area planning, rather than individual farm planning, gained further ground in the Regions during the year. The result was that the Regional Engineers were more occupied than

ever before with hydrographic planning for safe drainage and control of flood water and the planning of essential conservation works.

The work of the Regional Engineers in this connection progressed as follows:

- *Highveld Region:* In all 93 000 ha in the Upper Orange catchment are in various stages of planning; in addition, the following areas have already been planned at the request of farmers or are in an advanced stage of planning: Wilge River, Klerkspruit (Kestell), Dwaalspruit (Harrismith), Klein Vet River (Clocolan).
- *Free State Region:* The Egmont Dam catchment area (33 100 ha) has been completed and the analysis of aerial photographs and the field control of the Slikspruit catchment area (100 000 ha) has also been completed.
- All farm planning in the Nuwejaarspruit catchment area has been completed.
- *Karoo Region:* Palmietspruit, a third sub-catchment in the 20 catchments of the Upper Orange catchment area situated in the Karoo Region, has been completed. This brings the areas completed up to 15 per cent of the 920 000 ha situated in the Karoo

Eastern Cape Region: Five catchment areas with a combined area of 170 000 ha have been completed.

A few interesting findings that resulted from the planning and attendant inspections should be mentioned. Of the 167 existing works inspected in the Karoo, 44 were in good condition. On the other hand, 78 irrigation dams were damaged, unsafe or had other defects, which is a disquieting state of affairs.

Apart from a few malpractices at these irrigation schemes, such as the cultivation of poor soil, incorrect methods of cultivation and irrigation practices that are harmful to the soil, the low-lying land is being drained as a result of long diversion ditches intended to enlarge the catchment areas of the dams artificially. Moreover, the structures are not maintained in the customary way and the sodium content of many earthworks is dangerously high.

Special apparatus

The demand for special apparatus for research projects and other jobs is increasing. The following are a few of the numerous articles designed and manufactured:

A freeze-drying apparatus for Grootfontein.

Electrodes, designed by the Division of Agricultural Engineering, for use at the Grootfontein Agricultural College in obtaining ram semen for artificial insemination



Electrodes to obtain sperm cells from rams for artificial-insemination (Grootfontein).

In Natal a lister-planter was made from existing conventional parts for trials in leksand.

A cheap, small neutron moisture meter for the Winter Rainfall Region.

A sulphur dioxide control system for the Fruit and Fruit Technology Research Institute (F.F.T.R.I.) to regulate the sulphur dioxide in cold stores for grapes automatically.

An electronic apparatus for the F.F.T.R.I. to determine the water potential of leaves.

A cheap and portable radiation monitor for the F.F.T.R.I. to determine the presence of radioactivity.

An operating table for sheep.

An automatic sheep feeder for research work at Elsenburg.

An experimental apparatus for planting wheat in the Winter Rainfall Region.

Trailers for the transport of irrigation pipes.

A prototype lime applicator for the F.F.T.R.I. to spread lime evenly over a depth of 0,6 m in the soil.

The modification of a conventional planter to plant maize direct in unploughed stubble field or *Eragrostis* pastures, for use by the agronomy Section at Cedara in their non-cultivation trials.

Specialist extension and technical advice

The aim of the Division is to give the farmer all available information as soon as possible. Direct and indirect extension is, therefore, one of its chief tasks and has taken up more time during the past year than ever before.

A brief statement of the activities of the Assistant Chief Engineer and the three Principal Engineers of the Subdivision of Mechanisation in this field clearly shows how great the demand for specialist professional guidance and extension is.

Extension interviews conducted	199
Farms visited	307
Lectures given	55
Articles written	16
Interviews with firms	256
Firms visited	191

These activities include 11 farmers' days on dairy matters where the Assistant Chief Engineer addressed more than 700 farmers.

The weekly radio talks dealt chiefly with farm structures, tillage, the testing programme and the three series of test reports published, as well as with irrigation matters. The response to the talks on farm structures and the test reports was particularly favourable.

In the Winter Rainfall Region particular attention was still being given to the agricultural engineering



This shearing shed and offices at the Carnarvon Research Station were designed by the Division of Agricultural Engineering

problems of the fruit and wine industries. A few of the most important activities are the following:

Time studies and surveys in connection with the bulk handling of wheat: important weaknesses and needs were identified.

Improved wine-cellar designs and/or lay-out plans, which will be to the advantage of the entire industry, were drawn up at the request of over 20 wine-cellar owners. The recently completed wine-cellar belonging to

the Oranjerivier-wynkelderskoöperasie at Grootdrink, which is estimated to have cost over half a million rand, was completed in accordance with these improved designs. Some of the most important recommendations are contained in two publications that appeared during the year under review.

The critical inspection and redesign of a store for strawberries led to the design and adoption of a detached sorting rack that increased the productivity of the labourers. This design is arousing great interest.

9. Additional Services

PLANT STUDIES

Survey of aquatic higher plants

Surveys of water plants are of great importance, especially in view of the construction of large new dams which provide habitats for plants which are proving to be of increasing economic significance such as the water hyacinth *Eichhornia crassipes* and the pondweeds *Potamogeton* spp.

A survey of the pans of the Pongola River Flood Plains has just been completed. One of the objects of the survey was to prepare the ground for future work in this direction. Of the four survey techniques tried out, the Braun-Blanquet method proved to be most successful. The distribution of floating and rooted-floating aquatic plants was found to be primarily determined by wind action, while submerged aquatics were greatly affected by the intensity of light.

A project on higher water plants in the whole of Natal is being started.

Intensive plant collecting was continued in the North-Eastern Zululand in preparation for a detailed ecological survey. Several new species were discovered and a number of plants were recorded for the first time in South Africa. An investigation into the Bantu food plants occurring in the region was undertaken in collaboration with the C.S.I.R.

Economic Botany

A programme to collect and screen indigenous plants for economic potential is now well under way.

Poisonous plants — All the photographs required for an illustrated guide to the most troublesome poisonous plants in South Africa have been assembled. The preparation of the text is progressing well and a series of radio talks was given on the subject.

A number of cases of stock poisoning were investigated and numerous additions were made to the living collection of poisonous plants. These included several plants that cause dermatitis in man: *Euphorbia cotinifolia*, which is becoming popular as a garden plant



The Kogelberg area near Betty's Bay where surveys of fynbos vegetation are being undertaken by the Botanical Research Institute

in the Natal coastbelt, and *Rhus radicans* (American poison ivy) which has been reported from Pretoria, Grahamstown and the Natal south coast.

Edible plants — Several field trips were made to gather information on plants of value in survival situations.

Drug plants — The Department of Police and the Department of Health were provided with information on drug plants, including printed illustrations of *Cannibis sativa* for educational purposes.

Medicinal plants — Four hundred and twenty-three plant samples were collected for screening for anti-tumour activity

Weeds — Fifty more species or varieties were added to the living collection of *Opuntia* (prickly pear).

It is now evident that a great many representatives of this weed genus have been imported into South Africa.

Botanical information on various weed species was supplied to a number of research organisations. The most important weeds to receive attention were *Nassella trichotoma* (Nassella tussock) and exotic *Stipa* species, wiry tussock grasses that also invade the veld. One of these grasses, *Stipa tenuissima*, which has recently been recorded in South Africa for the first time, is already common in the Barkly East area.

Nassella has thus far been recorded from the Somerset East, Hogsback, Stutterheim, Cathcart, Moltano and Barkly East areas and is definitely spreading.



Red grass *Themeda triandra* is the most common flowering plant in South Africa

A one year-survey is being carried out to establish the existing distribution, ecological requirements and potential distribution of *Nassella* and exotic *Stipa* species.

Cytogenetics

Eragrostis curvula — A study is being undertaken to elucidate the reproductive mechanisms and the status of several taxa of the *Eragrostis curvula* complex and to study their ecology and distribution. A knowledge of these subjects is a prerequisite for selection and breeding in this economically important complex.

Opuntia aurantiaca (jointed cactus) — Efforts to find insect predators of the jointed cactus in South America are being hampered by uncertainty about the taxonomic status of the plant: it is possibly a hybrid of recent origin with few specific insect or fungal predators.

It is hoped that a cytogenetical study of *Opuntia aurantiaca* and its possible parents will unravel its taxonomic status. Some of the possible parents have been cultivated in the Pretoria National Botanic Garden and will be studied as soon as they flower and establish good roots.

National list of trees

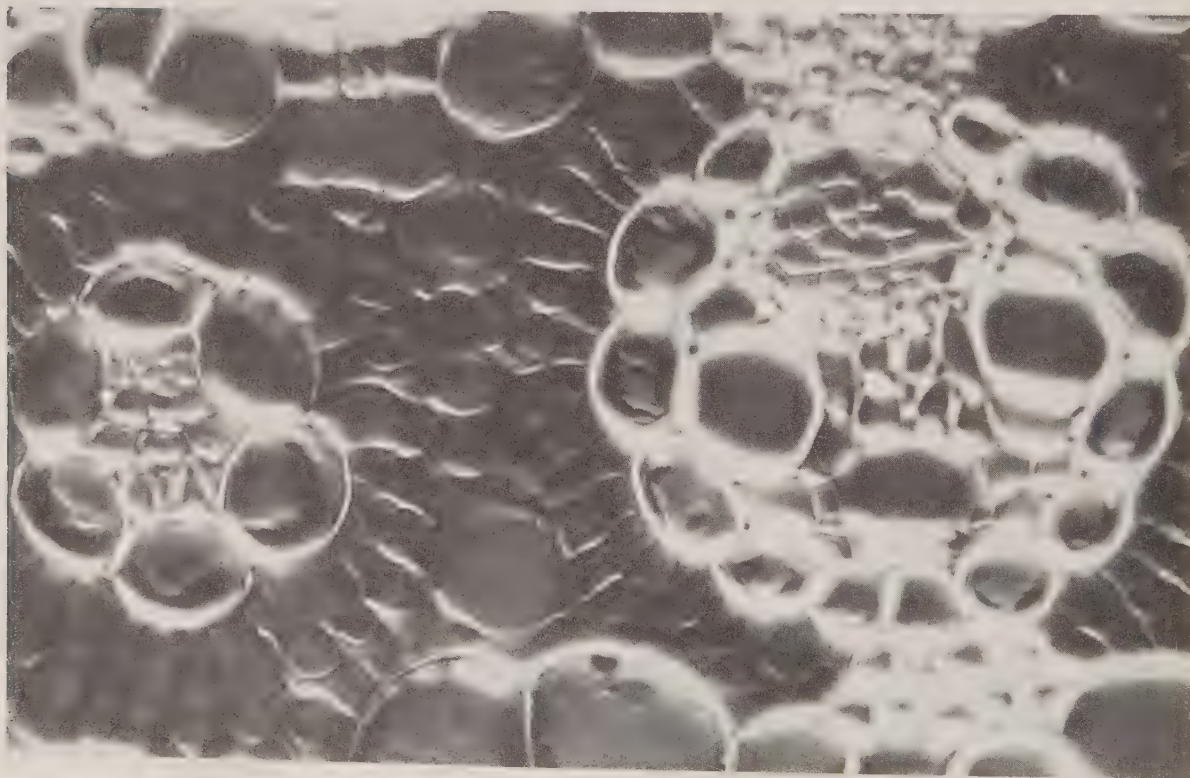
The attaching of numbers to trees in nature reserves, along main highways and in parks has become a popular means of identifying trees.

Numbers were first assigned to all South African trees in the book "Sixty-six Transvaal trees", written by members and ex-members of the Institute. This work is now out of print.

A national list of trees was recently published in the form of a bilingual pocket-sized booklet giving a numbered list of all South African trees, as well as alphabetical lists of scientific and common names.

Pretoria National Botanic Garden

A small plot in the garden on which a radio mast of the South African Broadcasting Corporation had stood was again incorporated into the garden. The garden has now reached its maximum extent, since it is completely surrounded by roads or residential areas. The new building that is being built for the Institute in the grounds of the garden is nearing completion. Plans for the development around the building have been drawn



A cross-section of a leaf of the red grass *Themeda triandra*, enlarged 320 times

up and good progress has already been made in implementing them. New roads to the building have been built and provided with electrical lighting.

On the northern side of the ridge that runs through the garden grounds good progress was made with the development of the properties that were bought during the previous year. Old buildings and about three hundred exotic trees were removed, water was laid on and big areas of ground were planted to grass.

Attention was again given to the development of ecological areas in the garden. A beginning has been made with the establishment of areas that will represent the Kalahari as well as South West Africa.

Two new boreholes, each delivering a good quantity of water, were sunk. The construction of two shade houses each with an area of about 450 m², was completed and two old shade houses were replanned, rewired, and provided with heating in the floor.

A big glass house with water cooling and floor heating was built.

The nursery now has some 30 000 plants of over 3 000 different species. In all, 556 new items were recorded.

SEED CONTROL

Breeding

Inclusion of new cultivars in the Variety List

The following table shows the kinds of plants, and number of cultivars of each kind, for which applications for inclusion in the Variety List were received:

Crop	Number of cultivars			Total
	Locally bred		Bred abroad	
	Offi- cial	Pri- vate		
Maize	—	28	8	36
Grain sorghum	—	4	9	13
Soya-beans	—	1	—	1
Cotton	1	1	2	4
Tomatoes	—	2	4	6
Peas	—	—	4	4
Dwarf beans	—	1	1	2
Grass	—	—	1	1
Carrots	—	—	4	4
Cabbage	—	—	4	4
Cauliflower	—	—	2	2

Cucumbers	—	—	2	2
Peppers	—	—	2	2
Lupins	—	—	2	2
Rice	—	—	1	1
Total : 1971/72	1	37	46	84
70/71	7	34	16	57
69/70	4	53	37	94

Maize and grain sorghum are still the most important kinds as regards applications for new cultivars to be included in the Variety List. Registration of cultivars for inclusion in the Variety List, especially of vegetable crops, has increased.

The following table shows the kinds of plants, and the number of cultivars of each kind, the names of which were included in the Variety List:

Kind	Number of cultivars included in the Variety List
Maize	26
Soya-beans	2
Cotton	2
Tomatoes	1
Onions	2
Cabbage	4
Dwarf beans	1
Total : 1971/72	38
1970/71	96
1969/70	38
1968/69	42

There was a large drop in the number of cultivars included in the list owing to the smaller number of registrations the previous year, and more maize cultivars were again included in the list than cultivars of any other plant.

To determine the agricultural value of the cultivars registered for inclusion in the Variety List, 112 trials were carried out with all the kinds at various places in the Republic. The data obtained from 87 of these trials could be used to do the necessary calculations with the computer.

Cultivar trueness — Altogether 5 232 samples were tested to determine cultivar trueness and purity, as against 3 170 the previous year. Tests were done on 53 kinds, maize, tomatoes, dwarf beans, grain sorghum, cabbage, onions and peas being some of the more important.

Plant breeders' rights

The following table shows the number of applications received for provisional plant breeders' rights and the plants concerned. (The figures for the preceding three years are also given for purposes of comparison.)

Kind	1971/ 72	1970/ 71	1969/ 70	1968/ 69
Dwarf beans	—	—	—	—
Babala	—	—	—	—
Groundnuts	—	—	—	1
Soya-beans	1	—	—	—
Oats	—	—	1	—
<i>Eragrostis curvula</i>	—	—	1	—
Nectarine	—	—	—	—
Rose	1	1	3	1
Peach	—	1	—	—
Plum	—	—	—	—
Grape	—	—	—	—
Wheat	—	2	—	—
Triticum	1	—	—	—
Grain sorghum	1	—	—	—
Pecan nut	1	—	—	—
Tomato	2	—	—	—
Total	7	4	5	2

Over this period, more applications were received for roses than for any other plant. Applications for the final granting of plant breeders' rights were received for 1 plum and 2 peaches.

Production and certification of basic seed

Maize

The following table shows the mass (kg) of seed of seed parent strains produced:

Group	Public strains	Private strains	Total
Open pollinated	451 022	61 699	512 721
Inbred	71 076	—	71 076
Single crossings	100 896	54 054	154 950
Total : 1971/72	622 994	115 753	738 747
1970/71	394 605	174 021	568 626

From these data it appears, *inter alia*, that:

170 121 kg more basic seed was produced than in the 1970/71 season; and

the production of basic seed of open-pollinated varieties increased by 225 086 kg, whereas the production of the other two groups declined by 54 965 kg.

Other kinds

The following quantities of basic seed of the kinds and varieties mentioned below were produced:

Kind	Variety	Mass (kg)	Maintained by
Sunflower	Seratovski	14 931	Highveld Region
Lucerne	Synthesis No.1	144	Karoo Region
Tomato	Roodeplaat Albesto	60	Horticultural Research Institute
Bean	Wintergreen	2 450	Horticultural Research Institute

Plant introduction

The following table shows the number of samples imported and exported by the plant introduction section:

Item	1971/72	1970/71	1969/70
Number of samples exported	961	646	387
Number of samples imported			
for rose gardens	5 928	17 047	—
for local researchers	833	77	683
for plant gene pool	413	412	—
Total	8 135	18 182	1 070

The number of samples exported increased by 50 per cent over the previous year.

Propagation material was imported from 36 countries and exported to 41 countries.

Plant gene pool

Preserving germ plasm ensures that valuable genes not needed immediately are maintained for future use:

449 new samples were placed in the gene pool; 100 samples of material in the gene pool were issued to South African research workers.

Domestic seed services

Control over the seed trade

The number of inspections rose by 52 per cent in comparison with the previous year.

As a result of more strict action and good co-operation on the part of most seed traders, who have the interests of the seed industry at heart, there has been a laudable improvement as regards compliance with all legal requirements relating to seed, and the standard has been raised substantially.

Registration of seed sellers and cleaners

The total number of registered seed sellers and cleaners is 410 (as against 421 the previous year), 346 of whom are registered as sellers and 64 as cleaners.

The registered seed sellers and cleaners are distributed over the four provinces as follows:

	Trans- vaal	Cape	Natal	O.F.S.	Total
Sellers	129	115	64	38	346
Cleaners	31	13	9	11	64
Total	160	128	73	49	410

Inspection visits

The following number of inspection visits were paid to seed sellers and cleaners in the various provinces to exercise control over the sale and cleaning of seed:

Province	1971/72	1970/71
Transvaal	909	582
Cape	718	452
O.F.S.	355	215
Natal	162	159
Total	2 144	1 408

Control over seed quality

To ensure that seed sold satisfies the prescribed requirements with regard to germination, purity and weed seed content, 1 366 samples were taken, as against 804 the previous year.

Advertising of seed

To ensure that advertisers do not illegally advertise seed of declared kinds, 2 631 seed advertisements in agricultural journals were checked. In 36 cases advertisers were warned that they were not permitted to advertise seed unless they were registered under the Seeds Act.

Checking of analysis results

The analysis results of 5 993 seed samples submitted by consignors for analysis were checked. In cases where the weed seed content, the germination capacity or purity did not satisfy the standards concerned, the consignors were informed accordingly.

Sealing of lucerne seed

The following quantities of lucerne seed were approved and sealed:

Place where approved	Mass of seed approved and sealed (kg)	
	1971/72	1970/71
Oudtshoorn/ Ladismith	876 870	996 272
Uppington	39 500	189 545
Johannesburg	0	48 772
Total	916 370	1 234 589

Prosecutions under the Seeds Act

The following number of prosecutions were instituted under the Seeds Act:

Province	Number of prosecutions instituted	
	1971/72	1970/71
Transvaal	85	38
Natal	39	8
Cape	23	13
O.F.S.	0	10
Total	147	69

Control over seed imported

Under the Seeds Act no one may import seed into the Republic unless it is seed of a variety whose name is included in the Variety List and which satisfies the prescribed requirements relating to germination capacity, purity and weed seed content.

Sampling of imported seed

To check whether imported seed satisfies these requirements, samples are taken of all declared kinds and used for the various determinations.

Altogether 1 804 samples of imported seed, 118 more than the previous year, were taken and analysed.

Durban, Cape Town and Johannesburg are still the major points of import for seed.

The total number of samples analysed was 18 460, which was 2 870 more than the previous year.

Reason for rejection	Mass (kg) rejected	Mass rejected as percentage of total mass imported
Germination too poor	15 400	0,34
Purity too poor	65 355	1,43
Weed content too high	7 307	0,16
Total	88 062	1,93

Seed testing research

Investigations aimed at improving seed laboratory techniques are constantly carried out, and special attention was given to improved germination methods for lettuce, beetroot, bean, onion and squash seed.

In addition, the Division was asked to design techniques for the germination of seed of the silverleaf bitter apple *Solanum elaeagnifolium* and the blessed milk-thistle *Silybum marianum*. These two plants are studied by the Plant Protection and Horticultural Research Institutes.

Field inspection service

In the execution of this function, the following schemes are administered:

The Basic Seed Scheme
The Seed Certification Scheme
The O.E.C.D. Scheme for Forage Crop Seed

The production of vegetable seed dropped by 233 130 kg during the year under review. This decline was caused mainly by a decrease of 527 ha in the area used for vegetable seed production.

In comparison with the previous year, 6 236 271 kg less hybrid maize seed and 71 755 kg more seed of other field crops was certified.

Altogether 28 832 ha was used for hybrid maize seed production, which was 6 826 ha less than the previous year. It is believed that the main reason for this decline in the area used for production was the

Under Seeds Act

	Under certi- fication scheme (basic seed included)	By public	By seed trade	Export seed	Import seed	For research purposes	Total
<i>Field crops</i>							
Total							
1971/72	6 105	2 405	877	505	386	2 316	12 594
Total							
1970/71	6 836	2 014	343	926	392	462	10 973
<i>Horticultural crops</i>							
Total							
1971/72	1 099	2 681	489	5	1 407	185	5 866
Total							
1970/71	674	1 863	464	10	1 315	291	4 617

preceding good production years, during which a surplus of 651 000 bags (of 50 kg each), viz 80 per cent of annual sales, accumulated.

Production of forage crop seed, mainly *Sorghum alnum*, increased by 65 487 kg.

Participation in schemes

Altogether 46 dealers and co-operatives and 849 growers participated in the various schemes. The number of growers was 124 less than the previous year and 751 less than in 1969/70. This consistent downward trend in the number of participants is ascribed mainly to good production years during which surpluses of seed accumulated, especially in the hybrid maize industry.

Seed production

In general, the rains in the Transvaal vegetable production areas were adequate, but in some areas excessive rain caused seed crop failures. During the ripening of the crop and harvesting the weather was good, and there was enough irrigation water.

The decline in beetroot seed production resulting from downy mildew *Peronospora schachtii* in the Oudtshoorn area meant that the Orange River irrigation area became a more important seed production area for beetroot and carrots. Further expansion of production may be expected here.

There was enough irrigation water available in the Oudtshoorn area, and this enabled producers to maintain their production level.

In the Baviaanskloof and Gamtoos areas, where there is great interest in seed production, floods did a great deal of damage to seed crops.

The price of land and the limited supplies of irrigation water, which are used for more profitable crops such as grapes and fruit, resulted in vegetable seed production in the Western Cape being stopped.

In general there were good rains in the maize seed production areas, and establishment could proceed normally.

Apart from hail damage in isolated places – altogether on an area of only 500 ha – and a dry spell during the latter stages of pollination, which had an adverse effect on hybrid maize seed production, conditions were generally favourable to the production of high quality seed.

The following table illustrates the relative importance of the various sources of hybrid maize seed:

Source	1971/72	1970/71	1969/70
Certified public hybrids	57%	65%	83%
Certified private hybrids	30%	26%	11%
Uncertified private hybrids	13%	9%	6%

The following table shows the quantities of seed that satisfied the requirements of these schemes:

Crop	S.A. Seed Certification Scheme (kg)	Export Seed Scheme (kg)	O.E.C.D. Scheme (kg)	Total
<i>Vegetable crops</i>				
Total : 1971/72	1 462 190	107 478	—	1 569 668
Total : 1970/71	1 649 323	153 475	—	1 802 798
<i>Field crops</i>				
Total : 1971/72	38 986 134	—	—	38 986 134
Total : 1970/71	45 150 650	—	—	45 150 650
<i>Forage crops</i>				
Total : 1971/72	155 816	—	25 541	181 357
Total : 1970/71	99 669	—	16 201	115 870
<i>Grand total</i>				
1971/72	40 604 140	107 478	25 541	40 737 159
1970/71	47 307 514	153 475	16 201	47 477 190

Private hybrids increased by 8 per cent in comparison with the previous season, and have increased by 26 per cent since 1969/70, at the expense of public hybrids. In comparison with the previous season, the contribution of the certified and uncertified private hybrids increased by 4 per cent. Certified private hybrids, however, showed the greatest increase, viz 19 per cent, as against only 7 per cent in the case of uncertified private hybrids.

Eighty-seven per cent of the total hybrid maize seed crop was certified under the South African Seed Certification Scheme. This was 4 per cent less than in the previous production year.

Seed production research

To obtain information on cross pollination in lettuce *Lactuca sativa*, which is usually self-pollinated, for isolation requirements, a pilot experiment was carried out with three different cultivars with exceptional marker genes. Progeny tests will be done in the next season.

Progeny tests were done with artificial crossings of Japanese radish *Raphanus sativus* and ramenas *Raphanus raphanistrum*, which is found in large concentrations in the Japanese radish production areas. The seed of these crossings produced strongly deviant plants with broad leaves and poor radish development. Further progeny tests are being carried out to determine how fertile the probable hybrids are.

International seed services

O.E.C.D. Scheme for Forage Crop Seed. — Only the Advisory Group met during the period under review. Altogether 25 541 kg of *Eragrostis curvula* seed was certified under this scheme, which was about twice as much as the previous year.

A start was made with the production of two lupin varieties from abroad under the scheme. The breeders' seed is supplied by an overseas firm, and basic and certified seed is produced in South Africa. The certified seed is then exported to the firm concerned.

O.E.C.D. Scheme for Vegetable Seed — South Africa has applied for membership of this scheme, especially with a view to producing vegetable seed for export, and the possible expansion of this industry. According to information received, South Africa's application was recommended to the Committee for Agriculture by the Advisory Group.

The International Seed Testing Association (ISTA). — Officers of this Division serve on the

following committees of ISTA: executive; rules; seed mixing and sampling; germination of seed; seed moisture and storage; coated seed; and flower seed.

The Association is at present reorganising its seed testing rules, but no drastic changes are expected. The reorganisation relates more to simplification and clarification of the rules.

The European Economic Community (EEC). — South Africa is still awaiting the result of its application to be granted equivalence as a third country as regards seed control and certifying services. There is every reason to believe that the decision will be favourable.

A compulsory communal variety list for beetroot, soilage crops, cereals, potatoes, oil-bearing and fibre crops comes into operation in the Community on 1 July 1972. Sales of seed in the Community will be limited to varieties in the communal list. The list is compiled from the national variety lists of the member countries. To qualify for inclusion in the list, a variety must be distinguishable, stable and homogeneous enough, and have enough cultural or utilitarian value.

Good progress is being made with the registration of South African lupin varieties in West Germany, and promising reports on the performance of the varieties concerned have been received.

The Commission for the Protection of new Plant Varieties (UPOV). — UPOV is an international body that is of some importance to South Africa. It is a commission responsible for the application of the Paris Convention for the Protection of New Plant products, 1961.

The following countries are already members of this convention: the United Kingdom, Denmark, West Germany, the Netherlands, France and Sweden. It is expected that several other countries will join in the near future. The convention relates to the granting of plant breeder's rights and co-ordination and promotion at international level.

Seed imports

Prices of imported seed have already started rising as a result of the devaluation of the rand. It is expected that this situation will help to induce local firms to obtain, where possible, their seed requirements in South Africa. Larger imports, especially of babala, forage and grain sorghum, cowpea, maize, watermelon and pea seed meant that South Africa's seed imports during this period exceeded those of the previous year by 1 767 470 kg (all kinds included).

During the year under review a total mass of 4 577 349 kg of seed of declared types was imported (2 809 879 kg the previous year).

The following kinds are the most important as regards imports:

Forage grasses	— Babala, feed sorghum and rye grasses
Forage legumes	— Cowpeas and medics
Field crops	— Maize and grain sorghum
Vegetable crops	— Garden beans, peas, vines, sweet corn and cabbage

On the basis of the mass of seed imported, the various groups of crops accounted for the following percentages (the figures for the previous year are also given):

Kind	1971/72	1970/71
Field crops	53,16%	43,9%
Vegetable crops	22,38%	32,4%
Forage crops	22,19%	21,2%
Forage legumes	2,27%	2,5%

Seed exports

The only statistics the Division has about seed exports relate to the seed for which the Orange International Analysis Certificates are issued, or seed to which the regulations of the Seeds Act apply. The following figures are, therefore, not complete because considerable quantities of other seed are also exported.

The table shows the kinds and quantities for which Orange International Certificates were issued for seed export purposes:

Kind	Mass (kg)	Number of certificates
<i>Lupinus angustifolius</i> (Blue lupins)	4 347 950	297
<i>Lupinus albus</i> (White lupins)	143	1
<i>Eragrostis curvula</i> (Weeping love grass)	352 770	77
<i>Eragrostis tef</i> (Teff)	10 000	1
<i>Phaseolus vulgaris</i> (Beans)	16 726	5
<i>Ornithopus sativus</i> (Serradella)	109 500	32
<i>Helianthus annuus</i> (Sunflower)	123 184	7
<i>Medicago sativa</i> (Lucerne)	601 600	76

<i>Pennisetum typhoides</i> (Babala)	14 000	3
<i>Atriplex semibaccata</i> (Saltbush)	1 278	3
Total : 1971/72	5 225 503	503
1970/71	10 053 808	865
1969/70	4 673 955	461

The decline in the mass exported was due mainly to the smaller lupin seed crop, which, in turn, resulted from an expansion of wheat production in the production area. There was a striking increase in the mass of *Eragrostis curvula* seed exported (the figure for the previous year was 41 459 kg).

The increase in the mass of certified maize seed resulting from the concession made by the Maize Board, viz exemption from export levy, was 33 939 kg.

NATIONAL COLLECTION OF INSECTS

Scale insects

Three field survey trips were undertaken to Zululand and Northern and Eastern Transvaal respectively. Samples of scale insects submitted for naming yielded additional material from localities in South Africa and adjoining territories. Approximately 170 accessions were made during the period reviewed. About a third of these has been determined while the balance awaits further attention.

Among the more important contributions made to our knowledge of South African Coccoidea are the following:

Four undescribed species of Diaspididae have been taken: A new species of *Pseudotargionia* Lindinger which has been described and figured in a paper completed recently and submitted for approval; a new species of *Ischaspis* Douglas which will be described in the near future; two new species, under study, which can be described only after comparison with species not yet represented in the National Collection of Insects.

The species *Parlatoria fluggeae* Hall and *Aspidiotus fularum* Balachowsky have been recorded for the first time from South Africa.

Asterolecanium stentae Brain, which has been known hitherto only from the original

description of 1920 which was based on material taken in Pretoria, has been recollected in Natal.

A number of new host plant records have been established for known species occurring in South Africa.

Soft scales and mealybugs

Routine identifications of Coccidae and Pseudococcidae were made for researchers in South Africa, South West Africa, Angola, Botswana, Ghana, Kenya, Tanzania, Uganda, France, Greece, Holland, Israel, Italy, the French West Indies and the U.S.A.

Work on the third part of the monograph of the soft scales of South Africa has been temporarily suspended to speed up research on the identity of the cochineals of South Africa, Argentina and Australia.

Work has continued on part three of the monograph of the mealybugs of South Africa. Following the study of supplementary material of old species made available from Kenya it has been possible to settle the identity of some forms of *Allococcus* not previously recorded from this country.

During the year reviewed three papers on Coccidae were published. One paper was also published in which are described four new genera of Pseudococcidae.

Beetles

Field survey activity, which was severely restricted through mileage economies effected during the year under review, was limited to two expeditions. One which traversed the karroid sectors of the Cape Province during November-December 1971 yielded an exceptionally fine collection of Coleoptera which was particularly rich in Buprestidae.

Malaise traps, which have been placed in operation at selected sites throughout South Africa have produced thousands of specimens of most insect orders. The yield of Coleoptera in general and Buprestidae in particular was exceptionally good. Many species hitherto not represented in the National Collection were taken and numerous new locality records were established in respect of other species.

Work on monographing the African Buprestidae has continued. The bibliography which is being compiled is 80 per cent complete (229 publications). Through extensive correspondence conducted with museums in South Africa and abroad it has already been established where 380 of the approximately 500 types of the group under study are deposited, while efforts to trace the balance proceed unabated. A total of 27 museums at home and abroad, including the British Museum (Natural History) and other important European institutions,

have sent their entire collections of unidentified Buprestidae to the National Collection of Insects for determination.

Preparation of the first part of the monographic study of the Buprestidae, in which will be treated the tribes Acmaeoderini, Norhomorphini and Polycestini, is about half completed.

A monographic study of a group of African tapping beetles was submitted as a doctoral thesis to the Department of Entomology of the Faculty of Agriculture at the University of Pretoria. One genus, 31 species and three subspecies are named and described for the first time in this thesis.

Fruit flies

Intensive work on the Dacinae of Africa has been continued. Figures and statistical data have been arranged in primary species groups and in character series in order to evaluate both previously used and new characters to generic classification. To some extent further dissections have been necessary for confirmation of some points and for comparison of later acquired material. Descriptions of 45 new species have been completed.

Further important dacine material pertinent to the study in hand has been received from Nigeria and assistance was given in checking lists of Nigerian Trypetidae. Specimens of two dacine species from Réunion were produced.

Tree hoppers and jumping plant lice

Two short collecting trips were undertaken to Rustenburg and the Eastern Transvaal which were mainly productive of Psyllidae.

Membracidae — All available African Membracidae have now been studied. Three papers were published during the year under review. In these, three new genera and 74 new species were described and illustrated.

Psyllidae — About 125 accessions have been made during the year. Light traps and Malaise traps have also produced useful material. Of especial interest is a good series taken at Rustenburg of a new genus and species.

A check list of the world genera of Psyllidae has been compiled. This should be of great help to future workers in this field. A catalogue has been prepared of Psyllidae contained in the National Collection of Insects.

Apart from a few species retained for description and drawing a proportion of most of the undetermined material in the Department's collection has been extracted and prepared for transmission to Mr Hollis.

psyllid specialist at the British Museum (Natural History), who is about to undertake a revision of the African Psyllidae.

The collection and mounting of leafhoppers in the Winter Rainfall Region was continued and a large number of specimens were collected, chiefly with the aid of mechanical suction equipment. Two publications on South African leafhoppers are in the press.

Termites

Three termite survey expeditions embracing 39 Natal and Transvaal districts established 24 new genus/district records: 1 223 colony samples were obtained from 208 collecting stations. An additional 42 termite series from Angola (2), Australia (3), Ghana (2), Ivory Coast (1), Kenya (3), Mozambique (14), Nigeria (2), Rhodesia (10), Uganda (1) and Zaire (4) boosted the 1971–72 increment of Isoptera to the National Collection of Insects to 1 264 series referring to 34 genera.

As at June 1972 the National Collection of Insects contained 26 604 colony samples of Isoptera.

Routine determinations of 123 series of termites were undertaken for various persons and institutions in South Africa, South West Africa, Rhodesia, Mozambique and the United States of America. Most noteworthy were analyses made of termites constituting the bulk stomach contents of steppe eagles and lanner falcons from South West Africa, hornbill species from the Kruger National Park and species of Kalahari skinks (*Typhlosaurus lineatus* and *T. garipensis*) from Botswana. These birds and reptiles are clearly largely termitivorous.

W.A. Sands, Centre for Overseas Pest Research, London, has completed and sent to press his revision of the soldierless termites of Africa, most of which have hitherto been lumped together as "*Anoplotermes*". During 1972 he named and returned to the National Collection of Insects a collection of 328 colony samples from Zambia, Swaziland, South and South West Africa which had been loaned to him for study some years ago. A further consignment of unnamed "*Anoplotermes*", containing 52 colony samples from South Africa, was despatched to Sands for naming during May 1972.

A start has been made with a series of papers dealing with the distribution of Isoptera in Africa south of Latitude 15° South. These are scheduled for publication, genus by genus, as consecutively numbered parts in Volume 3 of *Cimbebasia* (Series A). Parts 1, 2 and 3, in which the genera *Baucaliotermes* Sands, *Schedorhinotermes* Silvestri and *Psammotermes* Desneux are dealt with, were completed and sent to press in 1972. Work on part 4 in which the genus *Fulleritermes* Coaton is treated is under way.

A paper has been compiled in which are listed over 400 types of species and subspecies of Isoptera which are deposited in the National Collection of Insects, Pretoria.

A revision was undertaken of the Ethiopian genus *Unguitermes* Sjöstedt: four new species from West, Central and Southern Africa were described, new distribution records of old species were presented and the distribution of all species was mapped. The manuscript has been sent to press.

Through a statistical study undertaken of the soldiers of *Odontotermes okahandjae* Fuller it was established that the soldier caste of this species is dimorphic, not trimorphic as postulated by Fuller in 1922. The results, together with supplementary data on soldier polymorphism in other Ethiopian Macrotermitinae, were compiled in a paper published during 1972.

The book entitled *Animal Life in Southern Africa* published in 1971 by a Cape Town firm contains a review of the order Isoptera compiled and illustrated by the National Collection of Insects.

Four other papers were published during the year under review: The preliminary report on the termite survey of South West Africa, a report on soil poisons for proofing buildings against subterranean termites, a paper in which are described five new termite genera from South West Africa, and a paper dealing with new and old species of *Protermes* from Central Africa.

As a side issue to termite surveys conducted in South Africa a termitophile collection was made consisting of 236 specimens referring to 14 species in 10 genera of Insecta (Coleoptera and Diptera). Altogether 14 nests of 10 different termite host species were examined during these searches.

Specialist taxonomists named two species of Isopoda, one of Pseudoscorpionida and 15 of Coleoptera (4 Pselaphidae and 11 Staphylinidae) which were represented in 27 samples containing 277 specimens of South African termitophiles. Of particular interest are two new genera and species of Pselaphidae, taken respectively from nests of *Macrotermes vitrialatus* (Sjöst.) and *M. falciger* (Ramb.), described by N. Leleup, 1971. Types of these new taxa, *Trabisoxenus debeckeri* and *Kistneriella termitobia*, will be deposited in the National Collection of Insects.

Among the recently determined Staphylinidae of particular interest are two new species of *Termitusa*, respectively collected from nests of *Cubitermes bilobatus* (Hav.) and *C. truncatoides* (Full.) in the Waterberg of Transvaal, which will be described in due

course by D.H. Kistner. These constitute the first records of the staphylinid genus *Termitusa* in South Africa.

Plant lice

The National Collection of Insects is no longer actively engaged in aphid research. Three papers in which are compiled results of research done in past years on the wheat aphid *Schizaphis graminum* (Rond.) and its predators were published.

The large-scale collection of aphids by means of traps in the Winter Rainfall Region was continued. Research workers are concentrating on forms found on natural grasses. Four new species belonging to the *Sitobion* genus were found. Aphids have now been found on plants not previously known as host plants.

Locusts and grasshoppers

Three field survey expeditions covering selected areas of the Eastern Transvaal and Central and Southern South West Africa yielded an aggregate of 1 789 specimens of grasshoppers and 547 miscellaneous insects which are now being processed for incorporation into the collection. The last expedition proved to be the most productive, traversing areas not previously sampled and consequently yielding valuable additional material and several new range extensions.

Species of *Eneremius*, for example, previously known from the Lower Orange River area, were discovered near Keetmanshoop. This represents a considerable northern extension of its previous known distribution. A noteworthy discovery was a small series of *Lathicerus cimex* from the same locality. This species previously was represented in the collection by only three specimens.

Taxonomic studies continued and two reports were completed and submitted for publication. In one are described five new species of a previously little known genus.

Routine determinations of grasshoppers and enquiries concerning these insects and related matters were dealt with for members of the public and institutions both in South Africa and abroad. Material from the collection was donated to the State Museum, Windhoek and C.S.I.R.O., Canberra, Australia; information on specimens of Pyrgomorphidae in the National Collection of Insects was sent to Canada where distribution patterns are being compiled; material sent on loan to and described by Dr Kaltenbach of Austria was received back for deposition in the collection.

New accessions to the collection of wasp-parasites totalled 469. The majority of these came from rearings of scale insects and mealybugs collected on indigenous plants throughout the Republic.

Five papers were published on the taxonomic research of these parasites and several more are being prepared to include descriptions of many new species collected.

Nematodes

At present the national collection of nematodes consists of 10 041 slides representing about 50 000 specimens; 409 slides were added during the year under review.

A further study in the series on the genus *Xiphinema* has been completed and contains descriptions of two new species, viz *X. parvistilus* and *X. meridianum*. The study of the genera *Histotylenchus*, *Paratrophurus* and *Uligirosus* has been completed and contains descriptions of two new species. In addition, two species never previously found in South Africa were redescribed.

A third publication in the series on South African Criconeematidae appeared. Three new species are described, viz *Hemicriconeemoides sacchariae*, *Macroposthonic britsiensis* and *M. maskaka*.

As regards the non plant-parasitic groups, a study of the genus *Ironus* was completed and four new species were described, viz *I. ernsti*, *I. lautus*, *I. crassatus* and *I. dentifurcatus*.

A number of enquiries concerning the identification of nematode species on various agricultural crops was received during the year and dealt with. About 100 samples were examined for Departmental institutions such as the Transvaal Region, the Highveld Region, the Natal Region, the Division of Seed Control, the Horticultural Research Institute, the Division of Plant Pest Control and the Citrus and Subtropical Fruit Research Institute. Samples were also examined on behalf of farmers, home owners and private concerns.

In the course of the survey on the distribution of the potato root eelworm *Heterodera rostochiensis* and the sugar-beet nematode *Heterodera schachtii* 210 samples were examined. In addition, 68 samples were examined for the presence of these nematode species for farmers, the owners of smallholdings, and nurseries.

During the year under review about 100 new reprints, received from overseas nematologists, were added to the present collection.

Mites

Mite accessions during the year under review amounted to 631, with a total of 574 identifications. These included 46 for Israel and 352 for Angola. The identifications represent 69 species collected on economic crops and wild plants. The species identified included 30 phytophagous species, of which the following are the most important:

Oligonychus saccharinus Baker and Pritchard, which is harmful to sugar-cane in Mauritius, was found in South Africa for the first time — on sugar-cane at Mount Edgecombe.

The tulip mite *Aceria tulipae* (Keifer) was also identified in South Africa for the first time. It was found on tulip bulbs in a nursery in the Krugersdorp district. This species of mite is of great importance because it is not only a pest on tulips, but also attacks other crops such as wheat, sorghum species and maize. It has been found overseas that the tulip mite carries a mosaic virus, which causes leaf curl in wheat. In the U.S.A. it was also found that a disease called kernel red streak is caused in maize.

The European red mite *Panonychus ulmi* (Koch), which is of great economic importance overseas, was identified in South Africa for the first time this year. It was found near Elgin, Villiersdorp, Somerset West and Stellenbosch.

Pygmephorus mesembrinae Canestrini, which sometimes occurs on mushrooms, was found near Johannesburg; this is the first time it has been found in South Africa.

Large populations of *Tetranychus urticae* Koch occurred on maize between Devon and Kriel. The mite was also found sporadically from Devon—Kriel, past Bapsfontein and up to the Rietvlei Research Station. There was a great deal of mite damage on some farms near Kriel.

Large infestations of the citrus red mite *Panonychus citri* (McGregor) occurred on citrus at Rustenburg. In some orchards a great deal of damage was done before control measures were applied.

In the course of a survey in Angola 174 mite samples were collected on agricultural crops and wild plants. Other collecting trips in South Africa yielded a further 310 samples. This brings the total to 484.

General collection

Approximately 140 samples of undetermined insects were received for naming from members of the public and institutions in Southern Africa.

Three major collecting expeditions were undertaken during the past year through which extensive collections were made in South West Africa, Eastern Transvaal and Northern Natal. Rich yields of specimens were also gained from Malaise and light traps operated in various parts of Southern Africa. The composition of the total increment, with the approximate number of specimens presented in parenthesis against the various orders, is as follows: Coleoptera (5 400), Dermaptera (80), Diptera (700), Hemiptera (2 400), Hymenoptera (820), Lepidoptera (600), Neuroptera (60), Odonata (40), and Orthoptera (200).

During 1971–72 various groups of unnamed specimens present in the general collection of the National Collection of Insects were sent for determination to co-operating external specialist taxonomists.

The National Collection of Insects acknowledges with gratitude the receipt of an invaluable collection of Cicadelloidea donated by Dr T.J. Naudé. This collection contains the types of Naudé's species and named specimens of other rare taxa.

No less than 140 species of insects previously not represented in the National Collection of Insects were added to the General Collection during 1971–72.

The number of species represented by primary types has been augmented considerably during the past year through specialists depositing in our collections types of species described from material supplied by the National Collection of Insects.

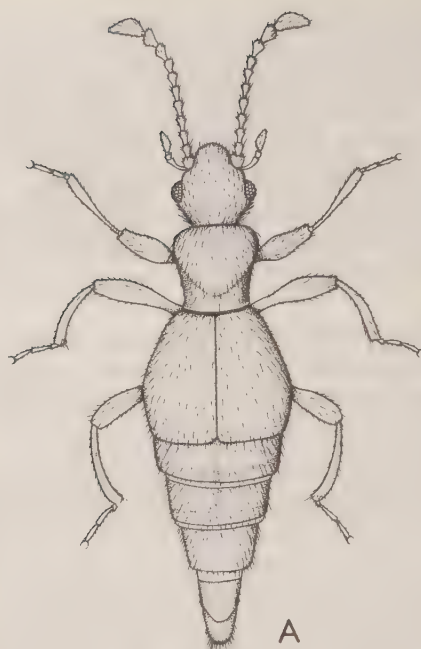
CONTROL OF OTHER PESTS

Golden nematode

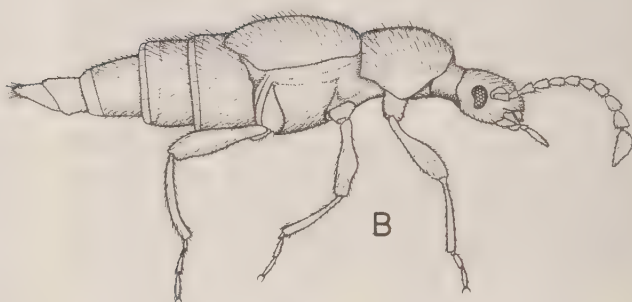
After the first outbreak of this dreaded pest in 1971 nation-wide surveys were started, especially in those parts where the host plants of the organism, viz tomatoes, egg fruit and potatoes, are grown. Surveys have already been completed in all the seed potato production areas in the country and in other areas where the host plants are grown intensively. Surveys in the remaining regions are being continued.

So far three different areas, viz two in the vicinity of Pretoria and one in and around the Witwatersrand complex, have been found to be infested.

In the three areas where potatoes and vegetables in particular are grown very intensively under irrigation, 52 plots were infested. The owners or occupiers of the plots concerned were forbidden to grow the host plants for a period of 10 years, or until regular sampling of the plots show that it would be safe to grow the crops again.



VB



Trabisoxenus debeckeri Leleup (Coleoptera: Staphylinidae), a new genus and species of termitophile described by entomologists of The Botanical Research Institute in 1971. It occurs in South Africa in nests of *Macrotermes vitrialatus* (Sjöstedt)

The total area infested in the three proclaimed areas is about 1 240 hectares. The degree of infestation varies from very high concentrations to fairly low concentrations of cysts in the soil.

Red-billed finches

During the winter of 1971 enormous concentrations of red-billed finches occurred in parts of Botswana. A week after the finches left Botswana large numbers were observed in the Limpopo Valley. Breeding conditions were very favourable in the spring and a fairly serious outbreak was expected. This outbreak did not, however, occur and the campaign was not at all intensive this season.

Control began early during the year under review (on 7 July 1971) and continued with interruptions up to 8 June 1972. The climax of the campaign occurred during January and February 1972 when more than 60 per cent of the concentrations were destroyed. With a few exceptions the campaign was waged mainly on the Springbok Flats and in the Western Highveld.

During the year under review 54 concentrations on a total of 501 hectares were destroyed and it is estimated that 17,4 million finches died.

Mice and gerbilles

As usual few complaints about damage by mice and gerbilles were received during the year under review. The ecological study of a small mammal community was continued.

The results indicate that variations in population densities may be ascribed to natural mortality, migrations and changes with regard to reproduction. There are also indications that mice and gerbilles usually do not reproduce during the Transvaal winter. The multimammate mouse, for instance, reaches a peak with regard to reproduction towards the end of the rainy season and at the beginning of the dry season. Rainfall and to a lesser extent temperature are, therefore, important environmental factors here. Multimammate mouse numbers may, therefore, be expected to be higher when the rainy season is very long. This means that there will be annual variations in mouse and gerbille numbers.

Recapture results, estimated sizes of the areas over which the multimammate mouse moves between catches, and sizes of territories indicate that poisoned bait placed at intervals of 20 metres (instead of 10 metres) in quantities of 20 grammes (instead of 5

grammes), should be effective for controlling this species. At the same time this would save labour and time.

Mites

Few complaints about the control of mites were received. This may be due to the good rains that fell during the year under review. Outbreaks of mites generally occur in dry, hot weather.

In the past a great deal of trouble has been experienced with the chemical control of *Tetranychus cinnabarinus* on strawberries, but during the past two years it has been found that a species of spider *Pardosa crassipalpis* can play a part in the biological control of *T. cinnabarinus*. Population studies of *P. crassipalpis* in comparison with *T. cinnabarinus* were continued and laboratory experiments showed that this species of spider feeds on the mites from the very first stages of development. There are indications that they can eat from 20 to 30 mites within three days. Further ecological studies are under way.

Because *T. cinnabarinus* and *T. urticae* have the ability to build up a resistance to miticides after repeated use, preliminary experiments with two organic phosphates and one hydrocarbon miticide were carried out. The purpose was to determine the mortality response of the various developmental stages of the two species.

The results obtained so far show that the developmental stages are more resistant to a specific concentration of a miticide than the adults are. This ability gives rise to selection pressure, which raises the potential for resistance of the particular strain. A further tendency has been observed in the developmental stages to become quiescent as soon as an irritating stimulus, such as a miticide, occurs in their environment. This could reduce the effectiveness of a miticide when used on the developmental stages.

It was also observed that the mortality of the mites does not always rise proportionally when the concentration of the miticide is increased. An explanation for this could be that the mites eat less of a nutritive medium contaminated with a high concentration of a miticide. Research on the matter is continuing.

European red mite

When it became known in February 1972 that the European red mite *P. ulmi* was present in the Republic, a survey to establish the extent of the pest was started. The survey was carried out on production units and nurseries in the areas concerned.

It appears that the greatest infestations occur in the Elgin, Caledon and Grabouw areas, where 15 production units and 3 nurseries are already infested. In addition the mite is also present in the Stellenbosch and Villiersdorp districts. However, no definite infestations could be found in the rest of the fruit-growing areas.

Quarantine measures, *inter alia*, are being applied to prevent the pest from spreading.

INSECT CONTROL AND RESEARCH

Brown locusts

During the autumn of 1971 the Department was involved in one of the most intensive campaigns ever against flier swarms of the brown locust *Locustana pardalina*. A large number of egg nests were formed and an intensive campaign against hoppers was expected to be necessary during the present season.

After the first spring rains the hoppers hatched in large tracts of the Karoo. The hoppers hatched from densely concentrated egg nests and the Department was able to take immediate action. The climax of the campaign was reached on 18 November 1971 when 296 teams were active against locust swarms in 64 districts.

Towards the end of December 1971 the campaign against the first generation was complete and the second generation hatched towards the middle of January 1972. A third generation occurred on a small scale in April and May 1972. In the last half of May a limited number of flier swarms from Southern Africa reached the Northern Cape.

Only a few egg nests were formed and fairly light infestations are expected for the coming season.

During the year under review 186 005 hopper swarms and 5 214 flier swarms were destroyed. The total quantity of poison used was 1 957 metric tons of B.H.C. powder and 43 200 litres of emulsion (concentrate).

Locust control cost R368 207 in labour, R194 763 in transport and R608 326 in poison. When the sum of R118 174 spent on repairs, parts, equipment and aerial surveys is included, the total cost is R1 289 470, as against R1 500 000 in 1970/71.

Experiments in the laboratory were continued to determine, *inter alia*, factors that can affect the resistance of brown locusts to insecticides. With the aid of these experiments the method of analysis has now been standardised so that insecticides can be evaluated very accurately. Various organic phosphate insecticides gave better results during laboratory analysis than gamma BHC — the insecticide being used at present.

Ultra-low-volume spraying against locusts with ground equipment was tested in the field. The results were very satisfactory. Ultra-low-volume spraying will be used on a large scale experimentally in the coming campaign.

From the results of further analysis the Plant Protection Research Institute found that liver samples from experimental sheep that grazed BHC-treated camps continuously contained 4,3 p.p.m. (parts per million) of the beta-isomer and up to 3,0 p.p.m. of the alpha-isomer. On the other hand, the beta and alpha isomer contents of the omental fat were as much as 94 and 55 p.p.m. There is no doubt that the use of BHC in locust campaigns could be an important source of BHC-isomer residues in man.

African migratory locusts

Small-scale outbreaks of African migratory locust hoppers occurred on about six plots on the Sand-Vet scheme near Bloubaai (Theunissen) and on two farms, the one in the Bothaville district and the other in the Viljoenskroon district, in November and December 1971. The locusts were destroyed. There was slight damage to wheat grown under irrigation that had already reached the threshing stage.

Armyworm

During the period under review 21 outbreaks of the greater armyworm *Spodoptera exempta* Walk. were reported. Apart from two fairly extensive outbreaks in Northern South West Africa, the other outbreaks were generally small and confined either to an area in the North-Eastern Cape and the South-Western Transvaal or were scattered in the Northern Transvaal.

A grid of 20 light traps was operated during the 1971-72 season - 16 in the Transvaal, 3 in the Cape Province and one in Natal. The insects were sent to Pretoria for identification as was done in the first season. Large numbers of moths were recorded from January onwards, numbers in April being unusually high due to the wet season and high temperatures.

The general survey of noctuids, saturnids and sphingids was completed at the end of May and a start was made on the evaluation of the field data. Good trapping records of *S. exempta* and the American bollworm *Heliothis armigera* Hühn., were obtained.

Observations on the significance of *Heliothis assulta* as indicated by light-trap catches have been completed.

Information on nine moth species of economic importance, including *S. exempta* and *H. armigera*, was exchanged on a weekly basis with entomologists

operating light traps in several neighbouring territories. At present there are five traps in Rhodesia, two in Botswana, two in Swaziland and one in Malawi. Eight to ten additional traps will come into operation in these territories in the near future. In addition, data from five traps in Zambia have been promised.

Up to the present this international project has been working on a semi-official basis, but it is hoped that an official working party can be formed soon under the auspices of the Standing Committee for Plant Protection of SARCCUS.

Karoo caterpillar

Although moderate to severe outbreaks of the Karoo caterpillar occurred in many parts of the Karoo Region, little attention was given to chemical control, which appears from research at this stage to be the most promising method. At present the high cost of spraying is a very limiting factor.

As regards mechanical and biological control, attempts were made to concentrate moths in localised areas with the aid of light traps. The idea is to concentrate the moths so that their natural enemies (vertebrate and invertebrate predators) can keep the populations down. Moths can also be destroyed by chemical means at the points where they are concentrated.

It is apparent from the large numbers of moths caught in light traps at night that intense light (ultra violet) is very successful in concentrating moths. Up to $1\frac{1}{2}$ million moths have been caught in a single night. During the trial period of 60 days $8\frac{1}{2}$ million moths were caught. The ratio of males to females showed interesting fluctuations - some nights 90 per cent of the moths caught were females but at other times 50 per cent were males. This phenomenon could mean a break-through in control measures, particularly with regard to the sterile male technique.

American boll-worm

The American boll-worm was a great problem, particularly on maize in the Eastern Highveld subregion, but caused less trouble in the South-Western Transvaal subregion than it did last season. In the latter subregion, and in the North-Western Free State subregion the incidence of the American boll-worm on grain sorghum made it necessary to spray.

In most cases, however, spraying specifically against boll-worm on grain sorghum is out of the question because boll-worm has to be taken into account when spraying for aphids. The addition or use of a suitable contact preparation when spraying for aphids usually provides adequate control.



The American boll-worm *Helicoverpa armigera* is the most important lupin pest in the Winter Rainfall Region

Boll-worm remains the most important pest on a wide series of field crops grown in the Winter Rainfall Region. During the year under review, however, early outbreaks were limited in extent because of the unfavourable wintering conditions of 1971. Late summer and autumn outbreaks large enough to be harmful did, however, occur in the Olifants River area where infestations of up to 30 per cent were found on harvested tomatoes. A wide series of insecticides controlled boll-worm effectively under experimental conditions.

Four different viruses were extracted from boll-worm larvae. During etiological studies the nuclear polyhedrosis virus performed similarly at 22,4°C and 27°C and showed an increased incubation period in older larvae. Affected larvae did not cease feeding until shortly before death, but moths were not affected. The progeny of infected adults survived poorly, probably due to virus material transmitted on the egg surface.

A granulosis virus isolated from droppings of the cattle egret killed about 75 per cent of boll-worm larvae exposed. Moths appeared unaffected by this virus, but about 80 per cent of their larval progeny died.

Termite control

When the harvester termite control unit was founded at the Plant Protection Research Institute in 1965, most agriculturists felt that the solution to the problem lay in effective chemical control, but since then research workers in the Free State and Karoo Regions and at the temporary unit at the Research Institute have pointed out that harvester termites are primarily an ecological and not a chemical problem.

The harvester termite control unit has completed its investigation. The present view of the problem, based on research undertaken by the three bodies mentioned above, may be briefly stated as follows:

Ecological aspects — The harvester termite is an indigenous insect that feeds on indigenous vegetation and may, therefore, be expected to be in equilibrium with its environment. When the natural equilibrium is disturbed by protracted droughts or by injudicious grazing, the damage it does becomes more noticeable.

Investigations indicate that in most cases the affected veld may be reclaimed by judicious grazing. It appears that it is only in exceptional cases that the termite population cannot be reduced to its normal size by systematic grazing.

These cases include parts where surface erosion over long periods has reduced the grass cover to such an extent that termites remove all the grass produced and the veld is, therefore, unable to recover. Under such conditions chemical control is justified, but it is estimated that no more than from five to ten per cent of the infested parts of South Africa are in this state.

Chemical control — Chemical control measures should be regarded as a long-term investment and not as a magic wand. This view is being confirmed by an investigation into the use of two insecticides applied on a large scale so far:

The use of sodium fluosilicate was started in 1954, and dieldrin was registered by the Department in 1965. In both cases the total area treated annually dropped to less than a quarter of the initial area within three years —

an indication that the farming community pinned its hopes on chemical control but was disappointed after some time. If producers lose sight of the value of complementary reclamation measures, they will probably also be disappointed in other preparations.

Insects in stored grain

A new approach to the storing of groundnuts, viz storing them unshelled and in bulk, led to a small-scale trial on the treatment of such groundnuts against insect infestation. Five preparations were tried and promising results were obtained.

A number of fumigation experiments were also carried out. Aluminium phosphide tablets were tested for the fumigation of export edible groundnuts in railway trucks on their way to the harbour. Good results were obtained, even at fairly low doses. Aluminium phosphide tablets were also tested for fumigating flour. The result showed that either the dose should be increased or the period of exposure should be extended.

Aluminium phosphide tablets were also tested for fumigating groundnut stacks. The results were satisfactory in general.

A trial was also carried out with methyl bromide at a lower dose than is usually applied under tarpaulins. At this dose the bromide residues in the fumigated groundnuts were under 50 p.p.m., the tolerance stipulated by West Germany. Effective insect control was obtained at this dose.

Wheat aphids

The three wheat aphids *Schizaphis graminum*, *Acyrtosiphon dirhodum* and *Macrosiphum avenae* were bred in the glasshouse and the laboratory of the Department of Entomology at the Faculty of Agriculture of the University of the Orange Free State. *Macrosiphum avenae* was particularly susceptible to attacks by parasites in the glasshouses. It is, therefore, doubtful whether it will ever build up to large numbers in the field.

Many data indicating that *Schizaphis graminum* is very sensitive to temperature were collected. The results indicate that this aphid would not be a great threat during a hot, dry spring, but could build up to large numbers during cool, damp spring months.

There are also indications that the part played by natural enemies is over-estimated and that climate is really the dominant factor in determining the incidence of the pest.

S. graminum occurs exclusively under dryland conditions, but *A. dirhodum* and *M. avenae* are found on

irrigated wheat. Both these species only reach pest numbers later in the season when the wheat has already formed ears.

An interesting possibility investigated is that *A. dirhodum* is a temperature variant of *S. graminum*.

Namaqualand vygie caterpillar (*Mesocelis* sp.)

Epidemic outbreaks of this pest again occurred in Namaqualand. The destruction of vygie plants, the chief constituent of the natural grazing in Namaqualand, is threatening to cancel out any advantages with regard to the recovery of the veld that followed the Stock Reduction Scheme. It is essential to find a solution to this problem. Pathogens and parasites able to keep the numbers of this pest down were observed during regular veld surveys in the Nuwerus area.

Forest and timber insects

In all 340 900 cubic metres of timber was imported during the year under review, as against 433 100 cubic metres the previous year. Of the timber imported during the year under review, 105 900 cubic metres were kept back for fumigation because of the presence of bark.

During the year under review 276 700 cubic metres were exported under cover of 11 health certificates.

Sixty timber merchants with high pressure treatment units in the proclaimed areas of Natal, the Eastern Cape, Border and the Western Cape were visited several times during the year under review. Irregularities were found in 26 cases.

678 New buildings in the same areas were visited during the year under review. Only in 7 cases was structural timber found that had either not been treated at all or had been treated unsatisfactorily.

Investigation into control measures, the role of natural enemies and the economic importance of the pine emperor moth *Nudaurelia cytherea clarki* Geertsema, the poplar emperor moth *Pseudobunaea irius* (F.) and the pine bark emperor moth *Holocerina smilax* (Westw.) was started.

In the case of the pine emperor moth defoliation takes place during the dormancy period of *Pinus patula* trees. In cases where more than one complete defoliation of this species may be expected, the loss in earnings from timber would be more than the cost of a single aerial spraying.

Defoliation by the poplar emperor moth and the pine bark emperor moth takes place during the growing

season and is more harmful than defoliation by the pine emperor moth. Chemical spraying is economically justified each time complete defoliation could be caused by these two species. Trees die back after two defoliations in one season or in two successive seasons.

With regard to parasites, the highest mortality is caused by egg parasites in the case of the pine emperor moth, and pupal parasites take the highest toll in the case of the poplar and pine bark emperor moths. Predators appear to be more important than parasites. The most effective predators were baboons against the pine emperor moth, falcons against the poplar emperor moth and guinea-fowl against the pine bark emperor moth.

It was found that *Syngaster lepidus* Brulle, the most important larval parasite on the phoracantha beetles *Phoracantha semipunctata* F. and *P. recurva* Newman, may be bred successfully. Parasites were released on a plot in Pretoria for the first time in November 1971. After six to seven months a female was found by chance near the plot. Considerable progress has been made with comparative bio-ecological studies of *P. recurva* and *P. semipunctata*; these studies have embraced distribution, host plants, natural enemies, flier activity and the life cycle.

Research on the bio-ecology of the Cape wattle lappet moth has reached an advanced stage. A report on the work was compiled.

Aerial spraying experiments using water emulsions containing DDT, Lannata and mercaptothion, have been completed. The best results were obtained with DDT applied at a concentration of 1 720 ml of active ingredient in 30 l of water per hectare.

A manuscript entitled "Forest and timber entomology in the Republic of South Africa", submitted during the 1971 Entomological Symposium, is ready for printing.

A research programme concentrating on the ecology of *Nudaurelia cytherea cytherea* has been undertaken in the Western Cape with the object of controlling the insect. The eggs of this moth were again collected from various localities in the Western Cape in order to obtain data on egg parasitism and the incidence of such parasites. Laboratory tests on *Mesocomys pulchriceps*, the most important egg parasite on *Nudaurelia cytherea cytherea*, are being carried out. The synthetic female sex attractant was tested and the provisional results seem promising.

An area of about 2 500 hectares in the Western Cape and 500 hectares in the Southern Cape, planted to *Pinus radiata*, were attacked by *Nudaurelia*. A smaller outbreak of *Nadisa concolor* occurred on *P. radiata* at

Jonkershoek. Little damage was done by defoliation and the pest was controlled by virus diseases and larval parasites.

Other timber insects to which attention was given, were *Pissodes* spp., *Anthua catocaloides*, *Gonimbrasia tyrreha*, *Pachypasa capensis*, *Oösomus hariolus* and *Bracharou dregei*.

A hand spraying trial on small *P. radiata* trees and an aerial spraying trial on medium-sized *P. radiata* were carried out against *Nudaurelia* larvae. Three insecticides with different formulas were tested and the results were promising.

Several specimens of *Criocephalus pinatorum* were caught in black light traps at the Wemmershoek State sawmill. In February full-grown *Criocephalus* larvae were found at the sawmill in *P. radiata* sawlogs from the State forest at Kraaifontein. Some of the larvae penetrated up to 20 cm into the wood and many logs could not be used as saw timber. Beetles also appeared in treated timber used for timber houses. Apparently damage caused by this beetle is confused with that caused by *Hylotrupes bajulus* and/or *Oxypleuris nodieri*, both of which are proclaimed insects.

Registration of insecticides

Some 600 applications for registration and/or amendments to existing registrations of insecticides and fungicides have been reviewed and recommended for registration under Act 36 of 1947. Reviewing applications for the registration of rodenticides which now also require registration following an amendment of the Act in 1970 have commenced.

The annual departmental communication "A Guide to the use of Insecticides and Fungicides in South Africa", was revised and appeared in June.

BENEFICIAL INSECTS

Biological control

The lucerne earth flea and black sand mite

The lucerne earth flea *Sminthurus viridis* and the black sand mite *Halotydeus destructor* were both present in harmful numbers. The imported natural enemies of both pests appeared to have made promising progress. Experimental results indicate a definite connection between earth flea numbers and bdellid mite numbers, with peaks in predator numbers being followed by low points in prey density.

There were indications under field conditions that the predator *Bdellodes lapidaria* is able to change the seasonal pattern of earth flea fluctuations a great deal.

Anystis sp. A., the predaceous mite imported from Australia in 1971 to control the black sand mite succeeded in surviving the local summer drought and was present in satisfactory numbers in the release site after the first autumn rains of 1972. This predator appears to be successfully established in South Africa.

Potato tuber moth

Rearing of two imported species of parasites was continued with the view to releasing them in the Republic's potato-growing areas. The North American *Bracon gelechiae* was found to be poorly adapted to tuber moth, was difficult to breed in the laboratory and its culture was consequently discontinued in favour of *Orgilus lepidus*, a species of South American origin. Small-scale releases of this species were made in the Transvaal Highveld and three recoveries were recorded.

During the past growing season 14 trial sites were utilized where various commercial insecticide spray programmes were evaluated and compared with totally unsprayed fields. Tuber moth damage at harvest was in the region of 3 per cent in biological control fields, — and almost zero in fields that were sprayed at least once a week; fields that received a spray programme with approximately 10-day intervals between sprays or haphazard applications exhibited significantly higher tuber moth damage.

Commercial spray applications directed against aphids or tuber moth included the following insecticides: parathion, endosulfan, azinphos-methyl, demeton-S-methyl, dimethoate, monocrotophos and disulfoton. Fungicide treatments had no detrimental effect on tuber moth parasite populations.

Lantana camara

Small numbers of *Octotoma scabripennis*, a leaf-feeding beetle, were released in three sites around Pretoria. At all sites the beetles successfully passed through one generation and at least at one site overwintering pupae and adults have been observed.

Laboratory culture of *Plagichammus spinipennis*, the stem- and root-boring beetle continues to present problems.

Opuntia imbricata

Dactylopius tomentosus, a cochineal first released in South Africa in April 1970, that thrives on *O. imbricata*, has multiplied very satisfactorily at release

sites in the Orange Free State. The cochineal has been distributed to a number of other infestations and its progress is being watched with interest.

Opuntia megacantha

The weevil borer *Cactophagus spinolae* is progressing well and several hundred new infestations were found in prickly pear plants at release sites near Uitenhage and Hankey. But for reasons unknown, the beetles are, as in the past apparently not increasing to the point where large-scale biological control of the residual prickly pear in this part of the Eastern Cape can be expected.

Opuntia tardospina

A large field experiment on a farm near Fort Beaufort was successfully concluded. On this property which was formerly very heavily infested with *O. tardospina* biological control by cochineal was integrated over a period of three years with chemical control by 2,4,5-T weedkiller.

In this way it was possible to reduce the total expected expenditure if weedkiller alone had been used by about R60 000. At the termination of the experiment in March 1972 *O. tardospina* had virtually been eradicated from the farm.

Opuntia aurantiaca

Studies of the insects and diseases attacking this plant in Argentina, its native habitat, were continued. Several shipments of insects and disease organisms were received in quarantine in Pretoria where they will, if possible, be maintained in culture until they are ready for field trial.

The research in Argentina has revealed botanical variability in the plant and its relatives there. This is puzzling and requires detailed botanical research to explain.

Honey-bees

The growth of the bee-keeping industry is characterised by two trends: one is the increasing number of people who are becoming interested and the other is the ever increasing demands by established bee-keepers for improved techniques to ensure more efficient operation. Extension work therefore continues to occupy much of the time of the research officers.

A short course was held at Bethlehem during May when about 30 beginners attended. Other extension work included 11 lectures given to various groups and many visits to individual bee-keepers.

The study of the bee flora continues. Detailed studies were made of five plants (2 aloes, 2 composites and 1 legume) to determine their potential for bee-keepers. In addition the numerous sunflower *Helianthus annuus* cultivars are being studied in regard to their attractiveness to honey-bees and the role honey-bees play in pollination.

The survey of the disease and enemies of honey-bees has shown that a conopid fly parasite and nosema, a protozoon parasite, are two problems which need further investigation. The conopid *Physocephala fascipennis* pupa has been shown to be parasitised which may account for pupulation fluctuations.

Another curious fact is that the percentage of male flies recovered from bees is less than ten. The work done on the microsporidian *Nosema apis* suggests either a physiological strain which is able to multiply in immature stages and in this is unlike the normal form which is associated with adult bees, or the presence of another distinct species.

Progress has been made with the work on degranulating honey. The time of the operation has been cut to 30 minutes, half of what was arbitrarily chosen as a standard.

Work is continuing with the design of prototype heat exchanger heads to improve the efficiency of heat transfer.

The winter feeding experiment using yellow and white sugars was abandoned because all the queens in the white sugar treatment died. The work is being repeated this season.

Problems were experienced in the laying worker research in that the small cages, 11 cm by 11 cm containing about 200 bees, made it difficult to feed the correct diet to induce them to produce eggs and to raise brood.

New techniques will have to be devised for the survey of insect pollinators in lucerne fields. The sweep technique using a net was not satisfactory because certain Apoidea were seen to work the lower level flowers and were not collected as a result.

Carpenter bees

The bio-ecology of carpenter bees in Southern Africa is being studied with particular reference to the natural regulation of their distribution and abundance. The relationship between carpenter bees, the indigenous flora and man and his crops will also be investigated.

Experimental carpenter bee populations containing a total of nine species have been set up at six sites: Salisbury, Mara, Potgietersrus, Buffelspoort, Pretoria and Stellenbosch. The carpenter bee populations have been allowed to build up naturally in decayed timber placed in sheds.

Xylocopa caffra is represented at all six sites and therefore provides a good standard of comparison for the behaviour of eight other species colonising the various sheds in different combinations. Specially designed traps have been placed under each of as many nest entrances as possible in the sheds to collect everything ejected by the bees.

The following data have been obtained through regular examination of waste material contained in the traps:

The amount of wood excavated by bees in nests of different ages at different times of the year, the numbers of adult bees of both sexes produced in each nest throughout the year, the numbers of eggs, larvae and pupae dying through parasitism or other causes in each nest, and a partial estimate of the numbers of adults dying at different ages.

Finally, it is intended to determine the food plants utilized by the bees through a study of samples of pollen paste ejected from the nests.

In nature the carpenter bee populations are controlled chiefly by predators such as woodpeckers, rodents and baboons which break open the nests and eat pollen paste, eggs, larvae and pupae. The availability and distribution of nesting wood in relation to food also has an important influence.

The carpenter bees under study show a marked preference for flowers belonging to the Papilionaceae and Labiatae, although other large flowers are also visited. The species which are least specialised in their requirements for nesting substrates are the ones attacking the relatively hard structural timbers of buildings.

The work done so far shows that carpenter bees will be relatively easy to breed in large numbers for the pollination of crops with large flowers such as granadilla *Passiflora*. Even at high densities populations are not limited by parasites and it seems, at least so far, that predators can be excluded by housing the bee populations in sheds. The field work on this project has reached an advanced stage.

MYCOLOGY

Identification

During the year a total of 243 fungi was identified on a variety of host plants and substrates.

Among these were several interesting species which had not been recorded or had been found only rarely before viz *Stagonospora curtisii* which causes a severe leaf spot of *Amaryllis* in Natal; *Colletotrichum coccodes* on tomato from Tzaneen area; *Thielavia terricola* from pear trees showing "papery bark" symptoms from the South-Western Cape Province; *Pucciniopsis caricae* from pawpaw fruit rot, Natal; *Beauveria bassiana*, *Isaria farinosa*, *Entomophthora* sp. and *Cordyceps* sp. on pine emperor moth larvae and several polypores namely, *Fistulina africana* on living tree, Mariepskop; *Polyporus versatilis*, *Polyporus inconstans* and *Fomes lividus* on decaying gum logs in the Eastern Transvaal; and *Polyporus amorphus* on decaying pine logs at Mariepskop, Eastern Transvaal.

Curatorial work

A total of 82 fungus specimens was incorporated into the herbarium. These included dried-down cultures of fungi on agar plates as well as dried-down specimens on various natural substrates. The number of specimens in the herbarium now total 44 700.

A total of 95 specimens of fungi were sent overseas on loan to various workers, whilst 3 specimens were received on loan for study by officers of this section. Thirteen cultures of fungi were sent to overseas culture collections whilst 28 cultures were sent to specific workers for identification.

The rearrangement of specimens in the herbarium and regrouping of material to facilitate storage and retrieval was completed during the year. As a result the herbarium is now able to accommodate many more specimens in the space available and offer better storage conditions and easy and precise location of any particular specimen.

Research

Mushrooms — The collection of suitable specimens of edible, inedible and poisonous mushrooms for preparing spore points, herbarium specimens, colour photographs and descriptions for a popular scientific booklet for use by laymen was continued. Good material and colour photographs of *Coprinus comatus*, *Amanita phalloides*, *Amanita pantherina*, *Termitomyces cartilagineus* and *Boletus edulis* were prepared.



A Bulida apricot clone (71/2) successfully established after 77 days of heat treatment at 38 deg. C. A growth point of 19 mm was used

Fungus on Eucalyptus trees — Further studies of a fungus causing death of *Eucalyptus* trees in plantations in Zululand which had been identified as *Phaeoelus manihotis*, revealed the fruit bodies to be similar to the type specimen of *Polyporus baudoni* previously described from the Congo. This fungus is associated with the death of trees of various species and is widely distributed in Central Africa. The geographical range of this fungus is now known to extend from the tropics right down to the southern coastal belt of South Africa. Its presence constitutes a threat to *Eucalyptus* plantations in South Africa.

Seedborne fungi — The study of the fungus flora of lucerne seed showed that a gradual decrease in the amount of infection took place during storage of the seed under cool, dry conditions. No new species of fungi were found on the seed. The results of the examination of further samples confirmed results obtained in previous years. The results are now being incorporated into a final report on this investigation.

An examination of the fungi borne on onion seeds was also initiated. It was found that in 4 samples examined *Aspergillus niger* was the dominant species, whilst *Aspergillus flavus* is also very prominent in the flora. In two samples of seed sterilisation of the surface with mercuric chloride or sodium hypochlorite solutions, did not diminish the amount of infection by *Aspergillus niger*.

These seeds also showed fairly heavy infection by storage fungi and *Aspergillus glaucus*. Poor germination on the agar media was obtained in comparison with the seeds of other samples. Few fungi other than species of *Aspergillus* and *Penicillium* were found on onion seeds.

Downy mildew fungi — A study to determine the species of fungi which cause downy mildew of maize and sorghum in South Africa was started during the past season. It was found that 15 per cent to 40 per cent of maize plants and 5 to 15 per cent of sorghum plants in fields of heavy clayey soil were infected with the disease in the Warmbaths and Nylstroom areas. No diseased plants were found in sandy soils.

The fungus which causes this disease was identified as *Sclerospora sorghi*, one of nine species reputed to be capable of causing this disease.

Maize plants affected with downy mildew and showing symptoms of crazy top were found on a farm near Delareyville on heavy soil. These plants were fairly mature and attempts to induce the causal fungus to sporulate in order to allow its identification failed. Circumstantial evidence indicated that the causal organism in this case was *Sclerospora graminicola*, a species capable of attacking a large variety of grass hosts.

Mycotoxin-producing fungi — A comparative morphological study of South African material of *Phomopsis leptostromiformis*, the causal fungus of lupinosis in sheep and various European collections was completed and a report published. The South African and European collections of this fungus were found to be identical and 4 names were placed in synonymy with *P. leptostromiformis*.

In co-operation with the Toxicology section of the Veterinary Research Institute it was definitely established that facial eczema occurs in sheep grazing artificial pastures in the Humansdorp area of the Eastern Cape Province.

A comparative morphological study of several South African isolates of *Pithomyces chartarum* as well as two other species of *Pithomyces* (*P. sacchari* and *P. karoo*) found to occur in South Africa, has been completed and submitted for publication.

Mycological surveys were conducted in camps where cases of photosensitivity in sheep occurred at 17 different localities. Several fungi isolated were found to be new species. One of these, *Pithomyces karoo* Marassas Schumann, has already been described and morphological descriptions of several others, including *Drechslera* sp. nov., *Pleurophragmium* sp. nov. and *Phaeoramularia* sp. nov. are currently being prepared.

None of ten species of fungi, isolated from camps where outbreaks of photosensitivity occurred, caused photosensitivity or typical lesions of geeldikkop, although it was found that *Myrothecium verrucaria* was acutely toxic to sheep.

Two isolates of *Fusarium moniliforme* from maize were cultured on autoclaved yellow maize and dosed to donkeys and horses. Two donkeys and one horse died of acute liver damage and haemorrhage. This investigation is being continued.

LEGUME RESEARCH

The chief subject of the research on legumes undertaken by the Plant Protection Research Institute is the *Rhizobium*-legume symbiosis.

The best *Rhizobium* strains for the legumes grown in the Republic were selected during the past year on the basis of field trials in various parts of the country. The best strains were supplied to private companies that manufacture legume inoculants.

Samples of 89 of the 97 batches of inoculant manufactured by private companies during the past year

were tested for effectiveness, and 46 were approved for marketing. The fact that 52 per cent of the inoculants were approved this year is an indication of a decided improvement in quality. The previous year only 25 per cent of the inoculants were approved for marketing for limited periods.

An investigation into the desirability of inoculating groundnuts and beans is progressing well; the trials should be completed within two years. Meanwhile a large number of effective *Rhizobium* strains have been successfully isolated for the indigenous clovers (*Trifolium africanum* and *Trifolium burchellianum*). However, more seed of these plants is needed to test the *Rhizobium* strains properly.

Analytical services

In terms of Act 36 of 1947 a total of 992 stock feed samples was taken by insectors from all the stock feed factories and mills in the Republic. On analysis about 89 per cent of these samples were found to comply with the prescribed quality requirements.

The Soil and Irrigation Research Institute analysed 16 021 plant, soil, water, animal organ and other samples and performed over 80 100 determinations on behalf of the various Regions and Institutes of the Department.

METEOROLOGICAL RESEARCH

General

A report on agricultural meteorological research in the Department was supplied to the Weather Bureau for inclusion in the national report on agricultural meteorology which member countries had to present at the fifth session of the World Meteorological Organisation's agricultural meteorology committee.

The appointment of Dr M.E.L. Buys, of the Soil and Irrigation Research Institute, to the Agricultural Meteorology and Climatology sub-committee (a sub-committee of the Permanent Committee on Soil Conservation and Soil Utilisation Planning) of SARCCUS has meant that the Department's research workers now also have a representative who can gain first-hand information on what is being done in Southern Africa in their line of work.

During the year under review, Mr G.C. Green of the Citrus and Subtropical Fruit Research Institute at Nelspruit drew up a detailed report on a study tour to the U.S.A. which was undertaken to visit bodies with major agricultural meteorological research units.

The co-ordination of agricultural meteorological research in the Department was carried out by means of visits to various Regions and Institutes.

Collection of meteorological data

The number of enquiries received has again shown that the existing sources of the climatic data required for agricultural research are still inadequate.

Altogether, 28 weather stations have been established in the Winter Rainfall Region. Among other things, these stations provide data for investigations in connection with the scheduling of irrigation and information about growth arrestment disease in vineyards along the Lower Orange and various problems encountered in the small-grain industry.

Nine weather stations were established in the Karoo and Eastern Cape Regions with a view to obtaining further research data on geeldikkop in sheep. One station was also put into operation in the Highveld Region for similar studies.

In addition to the above, one complete weather station and seven observation stations were established in the Transvaal Lowveld for the collection of wind data.

Climatic investigations

A good deal of preliminary work was done in Pretoria in connection with the evaluation of rainfall data for the whole of South Africa for use by agriculturists. During the year under review a series of 24 maps was drawn, showing the monthly rainfall that may be expected in 80 per cent of the cases (four out of every five years), as well as in 60 per cent of the cases (three out of every five years). These maps, which show how inadequate the rainfall in a large part of the Republic really is, will shortly be published in a suitable form.

Evapo-transpiration

In a study undertaken at Pietermaritzburg it was established that evapo-transpiration from full-cover red grass and paspalum pastures was roughly equal to the evaporation from a Class A pan. These conditions develop 3 to 4 weeks after germination.

On the basis of pan evaporation it is now possible, therefore, to schedule the irrigation of these pastures. At the same time a simple formula, in which air temperatures are used for the calculation of open pan evaporation, has been developed. Using this correlation, the water consumption of these pastures can, therefore, be calculated indirectly, provided air temperature data are available.

The model prepared during the 1970 Water Year for the determination of evapo-transpiration and irrigation requirements was used in the Lowveld for the irrigation of citrus, avocados, litchis and various other subtropical crops grown under different soil and climatic conditions. A bulletin giving full particulars of the model and of the evapo-transpiration and irrigation requirements of a variety of crops, will shortly be published. Several agriculturists and agricultural meteorologists worked together in the preparation of this bulletin, which is a comprehensive practical handbook.

Research into the irrigation requirements of onions was concluded and a publication on this subject was issued during the year under review

Rainfall studies

The rainfall analysis conducted at the Grootfontein Agricultural College to determine variations in the effectiveness of rain was finalised. During 1966 and 1970 there was a distinct drop in this effectiveness.

Wind-break studies

The horizontal wind profile in the absence of wind-breaks in the South-Western Cape was investigated during the first season. This investigation was carried out at the Bien Donné Experimental Farm, where 12 registering anemometers were placed in position facing north-west and south-east. At a later stage, artificial windbreaks will be erected and thereafter wind patterns will be determined again

A network of 37 wind measurement stations is at present being maintained in the following areas:

Kaapmuiden — Malelane — Komatipoort; the Eastern Cape Region (including the Sundays River; Gamtoos River and Uitenhage areas); the Citrusdal area; and the area round Rustenburg.

The available wind data relate to those months during which winds are most likely to cause damage to citrus. Although data have been collected for two years only, it is already becoming clear that certain distinct wind patterns are obtained.

By converting the wind data into values representing the hypothetical performance of the wind the damage potential was determined of wind coming from the dominant directions. This information is most useful in the planning of wind-breaks to reduce wind damage to a minimum. These data can also be used to good advantage in the design of irrigation systems.

Plant-climate relationships

Further studies were made of the influence of the weather and climate on the condition and composition of the veld in the unstable Eastern Karoo.

It was confirmed by phenological and meteorological data collected at various banana farms in the Lowveld that there is a very close correlation between the rate of growth (i.e. the number of leaves that develop during a unit of time) and the average air temperature. There were indications, however, that unfavourable farming conditions, such as insufficient moisture in the soil, have an effect on this relationship, and that the difference between the theoretical and actual growth rates can be a pointer to unfavourable conditions or malpractices.

In the case of litchis the data showed that the picking time was a function of both the flowering date and the development period. The length of the development period depends upon temperature conditions.

Determination of potential

The maize-growing potential of several Regions was investigated by agronomists working in close collaboration with agricultural meteorologists. In Natal research was done on methods by which probable dates of planting rains, as well as the likelihood of droughts during the critical stage of maize cultivation in January, can be determined.

Rainfall data for the area round Greytown were analysed and used to plot the occurrence of planting rains in spring and droughts during January. These maps can be put to profitable use.

A post-graduate student prepared a mathematical model with which the inter-relationship between rainfall, evaporation, transpiration, available soil moisture and harvests can be simulated. This model, which was tried out in respect of one particular soil type, was used for the calculation of days with moisture tension, which made it possible to determine the crop volume for a number of years. Actual crops obtained under conditions prevailing at Cedara were estimated with a high degree of accuracy

Winter temperature studies in the South-Western Cape

This project was concluded during the past season with the submission of a Ph.D. thesis by the former section head at the Fruit and Fruit Technology Research

Institute. The most important findings were graphically depicted on a series of maps. With the aid of existing criteria apple, pear, plum and peach growing regions were identified.

There are also maps showing the heat units below 10°C for the winter, with various combinations of heat units above 10°C for the summer. These maps even serve as a basis for agro-climatic classification which must be followed up in link projects of the agro-climatic key programme.

AGRICULTURAL TECHNICAL RELATIONS WITH FOREIGN COUNTRIES

Co-operation with African Countries

Technical assistance and advice

The Department's activity in this field is steadily increasing.

The following officers visited neighbouring states to investigate problems and give technical advice:

Dr C.W.A. Belonje of the Division of Veterinary Services went to Rhodesia to inspect abattoirs in Salisbury, Bulawayo and Gatooma with a view to importing meat.

Mr M.A. van den Berg of the Citrus and Subtropical Fruit Research Institute visited Swaziland in connection with tests to control the pine emperor moth in pine plantations.

Dr H. Brodrick and Mr W.J. Pretorius of the Citrus and Subtropical Fruit Research Institute visited Swaziland to make a survey of avocado cultivars and avocado diseases.

Mr H.J. Steynberg of the Transvaal Region visited Mauritius to investigate the livestock industry, particularly sheep.

Mr R. Borstlap of the South West Africa Region visited Rhodesia, to judge stock at the Marandellas show.

Prof. B.R. Roberts of the Faculty of Agriculture, University of the Orange Free State, was a guest speaker on the graduation day of the Lesotho Agricultural College at Maseru.

Mr H.S.J. Gehle of the Transvaal Region visited Rhodesia to judge at the Wankie District and Horticultural Society's show.

Dr M.C. Lambrechts and two senior officers of the Division of Veterinary Services took part in discussions in Botswana on border control, imports and exports of animals and animal products, and animal disease control measures.

Mr R. Böhringer of the Transvaal Region visited Rhodesia to study wheat cultivation.

Mr C.M. Havenga of Professional Auxiliary Services visited Lesotho to give advice in connection with biometry.

Mr A.J. Cronjé of the Division of Seed Control visited Lesotho to give technical assistance in connection with cultivar trials.

Messrs J.H. de Lange and A.P. Vincent of the Citrus and Subtropical Fruit Research Institute visited Swaziland in connection with experiments with the hybrid naartjie Ortanique.

Dr G.S. Bredell, Dr R.E. Schwarz and Mr A. van Oostrum of the Citrus and Subtropical Fruit Research Institute visited Swaziland to investigate diseases in citrus orchards.

Mr C.J. Hunlun of Plant Pest Control visited Lesotho to give advice in connection with the production of fodder potatoes.

Dr H.G. van Heerden of the Transvaal Region visited Rhodesia to give advice on the growing of cotton and on a physiological research programme.

Mr V. Nanni of the Natal Region, Prof. B.R. Roberts of the Orange Free State Region and Mr F.S. Greyvenstein of the Division of Agricultural Engineering visited Lesotho to lecture on the conservation of resources at the University at Roma.

Messrs. P. Schuurman and H. Hamman of the Orange Free State Region visited Lesotho again visited the Wool Board's stud farm at Quthing in connection with the finalisation of its planning.

Dr E.C.G. Bedford of the Citrus and Subtropical Fruit Research Institute visited Rhodesia to investigate the possibility of biological control of citrus pests on the Hippo Valley Estates.

Mr C.J. Hunlun of Plant Pest Control visited Swaziland to assist with the identification of potatoes and, together with Mr P.R. Groenewald, Botswana, to inspect seed potatoes in the Tuli block.

Dr M.K.P. Meyer of the Plant Protection Research Institute visited Angola to advise on the control of mites in citrus.

Mr M.J.A. Werger of the Botanical Research Institute visited Lesotho to study the upper catchment area of the Orange River.

Dr J.H. Huyser of the Division of Veterinary Services, and officers of the Abattoir Commission visited Lesotho during May 1972 to give advice in connection with the erection of an abattoir at Maseru.

Messrs H. Hamman and P. Schuurman of the O.F.S. Region visited the Quthing stud farm in Lesotho in April 1972 to assist with the culling and selection of sheep.

In May 1972 Messrs J.A. de Beer and J.H. Joubert of the Orange Free State and Highveld Regions visited Maseru to judge maize, sorghum and poultry at the agricultural show.

Mr P. Schuurman of the Free State Region visited Lesotho to assist with the purchase of stud rams.

The Republic also received various visitors from other countries in Africa in connection with Agricultural matters.

During January 1972 Lesotho's Deputy Prime Minister and Minister of Agriculture, Mr S.N. Maseribane, accompanied by scientists and others, concluded a successful visit to the Karoo and Eastern Cape Regions to investigate, *inter alia*, the training of students, the breeding of Merino sheep, Friesland cattle, drought-resistant forage crops, lucerne, etc.

Messrs Bradley, Drager and Slogrove of Botswana's Department of Agriculture visited the Kruger National Park during February 1972 to obtain information on the application of foot-and-mouth control measures.

In December 1971 twenty-one students accompanied by seven teachers from the Lesotho Agricultural College and led by Mr G.M. Botha of the Department of Agriculture in Lesotho, visited the Glen College of Agricultural to get an idea of the organisation of South African agricultural college.

Miss Marcia Costa of the University of Lourenco Marques visited the Veterinary Research Institute at Onderstepoort in October 1971 for further study in connection with surgical techniques.

Mr A.A. du Toit of the Ministry of Agriculture in Rhodesia visited the Soil and Irrigation Research Institute for discussions on the sampling and analysis of stock feed and fertilisers.

Mr R. Daoust (entomologist) of the Division of Agricultural Research in Botswana visited the Plant Protection Research Institute in July 1971 to study methods of breeding cotton bollworm larvae.

Mr W.P. Nts'Ekhe of the Department of Agriculture in Lesotho visited the Soil and Irrigation Research Institute in October 1971 to obtain information on water and soil analysis.

Messrs F. Sousa D'Almeida and M. da Costa of the Instituto de Investigaçus Agronomique visited the Crops and Pastures Research Institute and the Orange Free State Region during January 1972 to study the use of goats in the biological control of encroaching scrub and for discussions on bush encroachment.

Tsetse fly control

The annual spraying campaign in Rhodesia and Mozambique was again carried out successfully in 1971 and the objectives envisaged for the first phase of the campaign have now been attained. Any further spreading of the tsetse fly in these areas of Rhodesia and Mozambique, as well as in the Limpopo and Kruger National Park areas, has thus been averted.

A meeting on the planning of the 1972 campaign was held in Mozambique during December 1971 and was attended by Dr M.C. Lambrechts.

During February 1972 Dr B.C. Jansen, Chief Director of Veterinary Services, attended another meeting in Salisbury, in connection with tsetse fly control.

The annual meeting in connection with the campaign against the tsetse fly in the Caprivi complex, where the evaluation of progress and planning was discussed with veterinarians from neighbouring territories was held in Pretoria on 22 March 1972. The meeting was attended by delegates from the Republic, South West Africa and Angola.

Foot-and-mouth disease

Drs M.C. Lambrechts, P.R. Mansvelt and J.F. van der Merwe attended the Interterritorial Foot-and-Mouth Disease Advisory Committee's meeting in Malawi in October 1971.

In June 1972 a team of officers from the Division of Veterinary Services left for the Eastern Caprivi to vaccinate stock against foot-and-mouth disease to prevent this disease from spreading further.

Locust control

After the International Red Locust Control Services was dissolved during December 1970, the Republic, Botswana, Rhodesia, the Portuguese territories, Lesotho and Swaziland agreed to participate in a joint effort to control the red locust. It was also agreed that the Director of the Division of Plant Pest

Control in the Republic would be responsible for co-ordinating all reports on locusts from neighbouring territories.

SARCCUS (Southern Africa Regional Commission for the Conservation and Utilisation of the Soil)

The following countries are members of SARCCUS: Angola, Botswana, Lesotho, Malawi, Mozambique, Rhodesia, Swaziland, Sao Tome, Principe and South Africa (including South West Africa)

The Thirteenth General Meeting of SARCCUS which was to take place in Lesotho in April 1972, could not be held there and will take place in Pretoria from 18 to 22 September 1972.

SARCCUS's other activities during the year under review included the following:

Mr D.C. Lourens of the Division of Plant Pest Control attended a meeting in Mbabane, Swaziland, during July 1971 in connection with quelea control.

Mr A.C. Nel of the Division of Plant Pest Control attended a meeting in connection with phytosanitary control at Lourenço Marques from 19 to 20 July 1971

Dr M.C. Lambrechts attended a meeting on animal health in Malawi during September 1971.

Mr J.G. Louw attended a meeting on animal production in Malawi during August 1971.

The meeting of the Standing Committee on Plant Production held in Lourenço Marques during July 1971 was attended by Prof. A.J. Pienaar.

The meeting of the Standing Committee on Plant Protection held in Lourenço Marques during July 1971 was attended by Dr J.E. van der Plank.

The meeting of the Standing Committee on Animal Production in Blantyre during October 1971 was attended by Dr J.H. Hofmeyr.

In August 1971 Dr J.M. de Villiers attended the fourth meeting of the Soil Science Committee in Malawi.

In January 1972 Dr D.W. Immelman attended the meeting of the Standing Committee on Soil Protection in Malawi at which land use planning was discussed. Mr T.J. Kotze of South West Africa attended this meeting as acting chairman of the subcommittee for veld management

During July 1971 Prof. P. Burger and Dr F.J. Kok read papers during the SARCCUS course in connection with extension and education in Swaziland.

Dr M.C. Lambrechts attended a symposium on nature conservation in Lourenço Marques during September 1971.

Other conferences and meetings

In July and November 1971 Dr H.D. Catling of the Plant Protection Research Institute attended a meeting of the organising committee for the conference of the International Union of Citrus Virologists in Swaziland. The conference is to take place in Swaziland during August 1972.

During November 1971 Prof. P. Allen attended a symposium on macadamia nuts in Salisbury.

During September 1971 Prof. E.W. Laubscher attended the second scientific congress at Umtali, Rhodesia, as a guest.

Dr B.N. Wolstenholme attended a symposium on nuts during November 1971 in Rhodesia where he read a paper. He subsequently visited citrus and subtropical research stations in Rhodesia.

Dr W.G.H. Coaton of the Plant Protection Research Institute attended a symposium on termites in Salisbury in October 1971. He then made arrangements for a termite survey in Rhodesia during March 1972.

Co-operation with overseas countries

Visiting scientists and other guests

A number of overseas scientists and other persons visited the Republic to undertake specialised investigations or for other reasons.

A group of cattle breeders (271) from France visited the Veterinary Research Institute at Onderstepoort during November 1971 for information on diseases.

During February 1972 a group of oenologists and deciduous fruit producers from France visited the Oenological and Viticultural and the Fruit and Food Technology Research Institutes at Stellenbosch, and the Horticultural Research Institute at Roodeplaat for more information on the associated industries in South Africa, and to investigate production methods and refrigeration facilities.

A group of Canadian tobacco farmers visited the Tobacco Research Institute at Rustenburg in April 1972 for information in connection with cultural practices and the sorting of tobacco.

Mr H.W. Pauli of the Department of Primary Industries, Australia, came to South Africa on an

extended visit from January to February 1972 to study training services, farm planning, farm management, etc.

Two Japanese plant inspectors, Messrs A. Waki and S. Ishida, came to the Republic in May 1972 to inspect the packing and treatment of South African oranges, grapefruit and limes intended for export to Japan.

Messrs G. Bruge and C.E.E. Mat of France visited the Division of Engineering during November 1971 for information on agricultural mechanisation in certain climatic conditions.

Dr W.J.J. Calaris of the Botanical Museum and Herbarium in Utrecht, the Netherlands, visited the Botanical Research Institute from 9 September to 22 November 1971 to accompany botanists on botanical surveys.

Dr R.S. Hedger of the Animal Virus Research Institute in Surrey, England, visited the Division of Veterinary Services during October 1971 for information on control measures against foot-and-mouth disease in and around the Kruger National Park.

Dr G. Jacquemont of the Fruit Research Institute of Réunion visited the Fruit and Fruit Technology Research Institute, Stellenbosch, and the Horticultural Research Institute, Roodeplaat, in October 1971 to investigate research in connection with grapes.

Mr J.H. Leigh of the C.S.I.R.O., Australia, visited the Crops and Pastures Institute from 30 August to 17 September 1971 to investigate feeding experiments with sheep and goats in low rainfall areas.

Mr E.W.L. Lines of the C.S.I.R.O., Australia, visited Onderstepoort in November 1971 for information on the Institute's activities.

Dr C. Lora of Peru visited Onderstepoort from 15 September to 7 November 1971 to gain experience in the diagnosis, prevention and treatment of blood parasites in domestic animals, as well as the treatment of tuberculosis in cattle.

Lt Col. (Dr) R.M. McCulley of the Armed Forces Institute of Pathology, Washington, visited Onderstepoort during September 1971 for discussions on research.

Dr A.E. Newsome of the C.S.I.R.O., Australia, visited the Winter Rainfall Region and the Division of Plant Pest Control during September and October 1971 in connection with animal ecology and the control of rodents, particularly gerbilles.

Dr A. Rosenzweig, who is associated with the Kimron Veterinary Research Institute in Israel, visited

the Division of Veterinary Services in Pretoria and other sections of the Division at Stellenbosch and in the Western Transvaal during September 1971 to instruct officers on animal diseases.

Messrs A.J. Stanton and E.J. le Roux of the Canadian Government's technical apple mission visited the Division of Plant Pest Control and the Fruit and Food Technology Research Institute during October 1971 in connection with the possibility of exporting Canadian apples to the Republic.

Drs E.A. Vega and S. Frankel, who are associated with the Volcani Institute, Bet Dagan, Israel, visited the Botanical Research Institute from 27 August to 23 September 1971 for information on South Africa's botanical gardens and flower nurseries.

Mrs Wymywalen, a pony judge from Britain, visited the Transvaal Region in September 1971 to inspect the horse stud at the Nooitgedacht Research Station.

Technical assistance and advice

Apart from the visits of overseas scientists to the Republic of South Africa in connection with scientific and technical aspects of agriculture, correspondence concerning agricultural matters with official and private institutions and with persons throughout the world increased substantially. This correspondence served as a means of exchanging knowledge and led to an interchange of literature as well as herbarium, propagation and research material. For instance, plant material was supplied to, or received from, 46 different countries by the Division of Seed Control.

The Veterinary Research Institute received more than 1 600 samples for analysis from abroad and supplied foreign countries with over seven million doses of vaccine and antigens.

International organisations

International Standards Organisation (I.S.O.)

This organisation and its various subcommittees including ISO/TC 34, are responsible for determining international standards for agricultural products in the interests of international trade.

To co-ordinate the activities of the I.S.O., a local ISO/TC 34 committee was established on which all interested departments are represented. Dr J.C. Strydom, Chief Director of Horticulture, represents the Department on the committee. This ISO/TC 34 subcommittee works in close co-operation with the Codek Alimentarius Commission which was established to fix standards for all types of food products.

The South African Bureau of Standards, which is the co-ordinating body for the I.S.O. in the Republic, referred numerous proposals by subcommittees to the Department for comment during the year.

International Council of Scientific Unions (I.C.S.U.)

The Department participates in the International Biological Programme (I.B.P.) of this organisation. The C.S.I.R. acts as the liaison body and arranges for the Republic's representation in this organisation.

Projects of interest to the Department are undertaken by various officers of the Department in co-operation with the universities. Funds for this purpose are provided by the Department and the C.S.I.R.

International Seed Testing Association (ISTA)

The object of this association is to ensure that only disease-free seed of high quality is made available to the international trade. The Division of Seed Control is a member of the technical committees for rules, seed mixing and sampling, variety testing, germination of seed, seed moisture and storage.

International scheme for the certification of forage crop seed

This scheme falls under the Organisation for Economic Co-operation and Development (O.E.C.D.) in Paris and its chief purpose is to ensure that the seed bought and sold in the international trade is true to type.

International Society for Horticultural Science (I.S.H.S.)

The main purpose of this organisation is to promote the dissemination of scientific information on the various branches of horticulture by encouraging international co-operation, and to distribute the information so obtained to member countries.

Dr J.P. Botha, Agricultural Counsellor in London, and Dr J.C. Strydom, Chief Director of Horticulture, are members of the Executive Council, while various officers of the Department serve on other commissions, committees and working groups.

International Dairy Federation

The object of this organisation, of which South Africa is a member, is the co-ordination of services at an international level and the promotion of the sciences and techniques that have a bearing on dairy science. The Department is represented by a National Dairy Committee on which the Dairy Board, the Dairy Products Manufacturers' Association, the Department

and other interested bodies are represented. The Department contributes half of South Africa's annual membership fees.

Dr B.H. Bester of the Transvaal Region attended the annual meeting of the Federation during September 1971.

European Association for Blood Group Research

The Animal and Dairy Science Research Institute is a member of this organisation which holds biennial conferences to exchange information on the heritable characteristics of blood and other body fluids. This highly specialised information is of great value in the selection and breeding of animals. The Institute also participates in experiments, in comparative programmes.

Mr E.H.H. Meyer of the Animal and Dairy Science Research Institute attended the Thirteenth Conference on Animal Blood Groups and Biochemical Polymorphism in Austria from 26 June to 1 July 1972, where he read two papers.

Centre for Co-operation in respect of Scientific Research on Tobacco (CORESTA)

The object of this organisation, of which the Tobacco Research Institute at Rustenburg is a member, is to co-ordinate international research on tobacco. The centre keeps its members informed of new developments and techniques and supplies them with plant material.

International Commission of Agricultural Engineers (C.I.G.R.)

The aims of this Commission are mainly to promote the engineering profession at an international level by stimulating interest in the profession, to put engineers in different countries in touch with one another, to promote the science, to encourage the co-ordination of scientific research, to improve the training of engineers and technicians, and to institute a documentation service which will publish all suitable scientific contributions from agricultural engineers.

South Africa keeps in touch with the organisation through the S.A. Institute of Agricultural Engineers which, as a national body, has been awarded full membership of the Commission. The Department contributes half the annual membership fees.

International Wine Office (O.I.V.)

The aims of this body, of which South Africa is a member, include the collection, study and publication of scientific, technical and economic documentation on viticulture and the products of the vine such as wine, grapes, raisins and grape juice.

During April 1972 Dr J.G. Boyazoglu, Agricultural Counsellor in Paris, and Dr J.A. van Zyl, Director of the Oenological and Viticultural Research Institute, had discussions in Brussels with officers of the E.E.C. on the regulation of the wine market.

International Atomic Energy Agency (I.A.E.A.)

The main aim of this Agency is to promote international co-operation and co-ordination of research in the field of nuclear science as applied to agriculture, industry and health. The Department maintains contact with the Agency through the Atomic Energy Board.

An international food irradiation project was undertaken under the auspices of the I.A.E.A., the E.N.E.A. (European Nuclear Energy Agency) and the F.A.O. Together with various other countries, South Africa participates in the project by making an annual financial contribution.

Dr J.G. Boyazoglu, Agricultural Counsellor in Paris, is the Republic's permanent representative in the administration of this project.

The first technical report on the project was published at the beginning of 1972.

International Office of Epizootic Diseases (O.I.E.)

The O.I.E. is the largest world organisation concerned with the control of animal diseases and the promotion of animal health.

Reports on the occurrence of all animal diseases throughout the world are published regularly for the information of member countries.

Dr P.J. Howell of Onderstepoort attended the 13th Congress of the O.I.E.'s foot-and-mouth commission in Paris from 22 to 26 February 1972.

International Institute for Refrigeration

This organisation is concerned mainly with the co-ordination of scientific information and research results and the dissemination of such information to its members. As a member country, South Africa derives considerable benefit from the useful publications issued by the organisation and from attending its meetings.

It is hoped that a national committee, on which all associated organisations in the country will be represented, will be established in the near future. Such a committee will serve as a link with the International Institute.

A number of members in the Republic have already been recommended for nomination to the organisation's technical and scientific commissions.

Mr L. Ginsberg of the Fruit and Food Technology Research Institute attended the 13th Congress of the organisation in Washington during August and September 1971.

Congresses, meetings and study tours

Dr B.C. Jansen, Chief Director of Veterinary Services, and Prof. C.F.B. Hofmeyr attended the 19th World Veterinary Congress of the World Veterinary Association in Mexico City during September 1971. Dr Jansen then paid a goodwill visit to Buenos Aires and Prof. Hofmeyr visited Brazil.

Dr F.J. Haasbroek of the Fruit and Food Technology Research Institute at Stellenbosch attended the 4th International Conference on the peaceful use of atomic energy in Switzerland in September 1971.

Dr G.C.A. van der Westhuizen of the Plant Protection Research Institute attended the 1st International Mycological Congress in England from 7 to 16 September 1971. He then undertook a six-week study tour through England, Denmark and the Netherlands.

Prof M.E. Sumner of the Natal Region attended an international course on irrigation and a symposium on irrigation and salt control in Israel from 2 August to 4 September.

From August to October 1971 Mr L. Ginsberg of the Fruit and Food Technology Research Institute undertook a study tour in connection with the storage, packing and transport of fruit in England, Switzerland, Portugal and the U.S.A., after attending the 13th congress of the International Institute for Refrigeration in Washington.

Mr H.O. Gevers of the Natal Region attended a conference on high-lysine maize in the U.S.A. in July 1971, after which he undertook a study tour of the main maize and plant breeding institutions in Germany, Mexico and Brazil.

Dr C.M. van Wyk, the Chief Director of Animal and Dairy Science, attended the international congress on animal production in Paris during July 1971.

Mr G.M.M. Erasmus of the Horticultural Research Institute attended the second world cherry conference in Italy in June 1972 and also undertook a study tour in England and Europe to investigate the cultivation of strawberries and cherries.

Dr J.E. van der Plank of the Plant Protection Research Institute attended a symposium on rice cultivation and pests in Bogota, Colombia, in October 1971.

Mr W.J. Uys of the Division of Agricultural Engineering and Dr A.D. Nieuwoudt of the Soil and Irrigation Research Institute attended a course on drip irrigation and a meeting in connection with irrigation in Israel in September 1971.

Dr P.J. Klesser of the Horticultural Research Institute attended the International Rose Conbention in New Zealand in November 1971 and read a paper on virus diseases in roses.

Dr J.G. Boyazoglu, the Agricultural Counsellor in Paris, attended a symposium on viticultural physiology in Bulgaria during Septmeber 1971

The 5th international congress on essential oils held in Brazil in October 1971 was attended by Dr K.L.J. Blommaert of the Fruit and Food Technology Research Institute.

From 21 September to 4 October Mr M.G. Steyn of the S.W.A. Region attended the 2nd international Karakul symposium in Rumania and undertook a nine-day study tour in West Germany

From 30 July to 12 September 1971 Mr J.A. van Blommestein of the Citrus and Subtropical Fruit Research Institute undertook an extended tour of the U.S.A., the West Indies, Brazil, Hawaii, Taiwan and Australia, to make a study of pineapple production.

From September 1971 to January 1972 Dr H.T. Brodrick of the Citrus and Subtropical Fruit Research Institute visited the U.S.A. and South America to study root rot in avocados.

Dr P.J. Klesser of the Horticultural Research Institute visited the U.S.A. from 6 August to 8 October 1971 to study virus certification schemes and viral diseases in groundnuts.

Dr J.E. van der Plank of the Plant Protection Research Institute visited Holland from 25 August to 3 September 1971 to study the epidemiology of plant diseases.

An extended study tour of the U.S.A., England, France and Germany was undertaken from 2 September to 30 October 1971 by Mr D.J. Bosman of the Animal and Dairy Science Research Institute to study beef cattle performance testing schemes.

From 12 September to 25 November 1971 Dr A.J. Heyns of the Fruit and Food Technology Research Institute visited Australia, England, Holland, the U.S.A. and New Zealand to study fruit diseases, control measures, rootstocks, new cultivars and plant improvement schemes.

During July and August 1971 Mr R.J. van Wyk of the Tobacco Research Institute at Rustenburg undertook a study tour of the U.S.A., Canada, Holland and England to investigate the latest developments and techniques concerning plant pest control preparations for tobacco.

From 15 July to 31 October 1971 a course on agricultural mechanisation in Paris was attended by Mr C Hawkins of the Division of Agricultural Engineering. He then investigated glasshouses in France, Holland and England.

From 11 September to 16 October 1971 Prof. D.K. Strydom of the Winter Rainfall Region visited England, Holland and the U.S.A. to obtain information on plant improvement schemes.

In October 1971 Dr E.C.G. Bedford of the Citrus and Subtropical Fruit Research Institute visited Israel to investigate the possibility of importing Israeli grapefruit and paid particular attention to control measures in respect of insects and mites in Israeli citrus that do not occur in the Republic.

From January to April Mr A.H. Mentz of the Vaalharts Agricultural Research Station attended a course on "French bovine stock in relation to the increase of meat production" in France.

A French study session on agricultural hydraulics, lasting more than two months, was attended by Mr J.W. Badenhorst of the Division of Agricultural Engineering at the beginning of 1972, in France. Mr P.E. van Rooyen of the Winter Rainfall Region also attended this course

Agricultural Counsellor, London

The incumbent of this post is Dr J.P. Botha and his main function is to supply the Republic with information on agricultural developments in the United Kingdom, the Republic of Ireland and the Scandinavian countries, and also to act as liaison officer between agricultural organisations in those countries and South Africa.

The following particulars give an indication of his activities:

Visits to research institutes, farms, etc.	20
Conferences and meetings attended	5
Special investigations on which reports were submitted	10
Reports and publications sent to the Department and other organisations in the Republic	401
Number of South African visitors for whom itineraries were worked out	19

Interviews granted to other visitors from South Africa	65
Number of visitors to South Africa to whom assistance was given	4
Interviews granted to non-South Africans	54
Bursary students and other South African students to whom assistance was given	5
Plant material sent to South Africa (number of varieties)	50
Newsletters compiled and sent to the Department	11
Articles written for Farming in South Africa	3

the Netherlands, Belgium and Luxemburg, as well as Spain, Portugal, Switzerland, Austria and Greece. The duties of this officer are more or less the same as those of the Agricultural Counsellors in London and Washington except that, owing to the different nationalities he serves, a great deal of translation work from various languages into English or Afrikaans and vice versa has to be done in order to make the information available in South Africa or in the other countries in the languages concerned.

The Agricultural Counsellor in Paris plays an even more important role than the other Agricultural Counsellors in acting as liaison officer between the various international organisations of which South Africa is a member. He is, among other things, South Africa's authorised permanent representative in the administration of the international food irradiation project.

The range of his activities can be summed up as follows:

Plant material sent to and received from South Africa	187 samples
Publications sent to South Africa	3 225
Reports sent to South Africa	12
Newsletter sent to South Africa	11
Confidential reports sent to South Africa . .	6
Articles and conference reports drawn up .	9
South African visitors assisted (two groups of visitors)	74
Bursary students and other South African students to whom assistance was given (those who attended the A.C.T.I.M. courses)	8
Congresses, meetings and exhibitions attended	20
Visits to research institutes, farming organisations, etc.	19

Agricultural Attaché, Buenos Aires

The present incumbent of the post is Mr J.C.D. Retief and his functions correspond with those of the Agricultural Counsellors.

Mr Retief visited, *inter alia*, those parts of Argentina where South Africans settled after the South African War. His visit to the Alto Valle del Rio Negro brought important facts to light about fruit farming in that area: apples and pears of a good quality are produced there and their production is still expanding. Argentina is now the main supplier of apples to the U.S.A., West Germany, the Netherlands, Norway and Sweden.

The Africander Cattle Breeders' Society made a gift of Africander cattle to Argentina and later also to

Agricultural Counsellor, Washington

Dr G.C. van Drimmelen, who had been the Agricultural Counsellor in Washington since 2 June 1966, ended his period of service there on 25 March 1972. He was succeeded by Dr P. Hildyard who arrived in Washington on 28 February 1972. The duties of the Counsellor in Washington are more or less the same as those of the Agricultural Counsellor in London, and the following data give an indication of the scope of the activities involved:

Visits to research centres, universities, experimental farms, etc.	104
Conferences, meetings and symposia attended	32
Investigations reported on	41
Reports and newsletters sent to the Department	89
Publications and mimeograph material sent to South Africa	3 610
Visitors from South Africa to whom assistance was given	81
South African students who attended courses and to whom assistance was given	23
U.S.A. visitors to South Africa to whom assistance was given	8
Samples of seed and plant material sent to South Africa	1 867 items
Animal material sent to South Africa	5 samples
Number of articles submitted for publication in South African agricultural magazines and Farming in South Africa	5

Agricultural Counsellor, Paris

The incumbent of this post is Dr J.G. Boyazoglu, who has been assisted by Mr J.A. Thomas, the Agricultural Attaché, since December 1970. Apart from France, Dr Boyazoglu's area of activities includes the five other E.E.C. countries, namely West Germany, Italy,

other South American countries. Mr Retief played a big part in the successful placing of these animals in the various countries. The value of the cattle for those areas is now fully realised.

Interviews granted to non-South Africans	34
Plant material (number of varieties) sent to South Africa	18
Articles written for Farming in South Africa	2

The attaché's other activities are the following:

Visits to research institutes and farms	40
Conferences and meetings attended	5
Special investigations on which reports were submitted	2
Reports sent to the Department and other organisations in the Republic	2
Number of South African visitors for whom itineraries were worked out	2
Interviews granted to other visitors from South Africa	6
Number of visitors to South Africa to whom assistance was given	7

PERSONNEL DEVELOPMENT

The Establishment

Posts

The following table shows the number of posts in the Department (under the separate Divisions into which posts in the public service are divided) as at 30 June 1972, as well as the number of vacancies in each Division, compared with the corresponding period last year:

Division	30.6.1971			30.6.1972		
	Authorised posts	Posts vacant		Authorised posts	Posts vacant	
		Number	%		Number	%
Administrative	132	4	3,0	135	5	3,7
Clerical	468	14	3,0	465	25	5,4
Professional	1 719	168	9,8	1 715	182	10,6
Technical	1 550	87	5,6	1 534	125	8,1
General A	87	6	6,9	86	4	4,7
General B	2 239	214	9,6	2 296	287	12,5
Non-classified (including Coloured and Bantu posts)	326	37	11,3	323	44	13,6
Posts additional to the authorised establishment on a temporary basis	90	13	14,4	53	5	9,4
Total	6 611	543	8,2	6 607	677	10,2

Increase in the number of authorised posts in the past five years

Division	30/6/68	30/6/69	30/6/70	30/6/71	30/6/72	Total % increase or decrease
Administrative	99	118	123	132	135	+ 36,4
Clerical	480	500	471	468	465	- 3,1
Professional	1 742	1 721	1 746	1 719	1 715	- 1,6
Technical	1 410	1 480	1 559	1 550	1 534	+ 8,8
General A	102	96	88	87	86	- 15,7
General B	2 008	2 238	2 277	2 239	2 296	+ 14,3
Non-classified*	215	329	355	326	323	+ 50,2
Total	6 056	6 482	6 619	6 521	6 554	+ 8,2

*Non-classified posts do not include posts additional to the establishment

General

In line with Government attempts to control inflation, the following measures were introduced on 1 April 1972 in order to control expansion of the establishment to a greater extent, to stabilise the staff position and to achieve better utilisation of man-power in general.

- (a) The vacancy percentage at every entry grade was reduced to 5 per cent on 1 April 1972.
- (b) Organisational and establishment inspections by the Inspectorate have provisionally been suspended until 31 March 1973.
- (c) The Division of Work Study still has to concentrate very closely on the application of techniques of short-term control.
- (d) No funds for normal establishment expansion were allocated to the Department during the present financial year.
- (e) Funds saved by the abolition of the vacant posts in the entry grades may only be utilised for the creation of essential production posts in those grades where there are no vacancies and candidates are readily available.
- (f) No *ad hoc* proposals regarding normal establishment expansion or the regarding of posts may be made to the Commission during the present financial year.

Establishment inspections

Inspection reports have been implemented at the following institutions of the Department during the period 1 July 1971 to 30 June 1972:

Plant Protection Research Institute, Virus Diseases Section	— 1 July 1971
Division of Veterinary Services, Section for Meat Hygiene and Related Matters	— 1 July 1971
South West Africa Region (supplementary report)	— 1 August 1971
Division of Veterinary Services, Section for the Administration of the South West Africa Veterinary Region	— 1 August 1971
Horticultural Research Institute	— 1 October 1971
Citrus and Subtropical Fruit Research Institute	— 1 March 1972
Fruit and Fruit Technology Research Institute	— 1 March 1972

Oenological and Viticultural Research Institute (supplementary report)

— 1 March 1972

Organisational changes

Single subdesignations have been applied to posts of Chief, Senior and Professional Officers with effect from 1 July 1971 to facilitate identification in the establishment as well as the position of officers on the seniority list.

As a result of economy measures, the Department ceased its activities at the Pongola Bushveld Experimental Farm (Natal Region) as well as at the Wheat Board's experimental farms Braklaagte, Goossens, Holfontein and Aspley (Highveld Region). The closing also of the Barberton Research Station and Losperfontein Experimental Farm (Transvaal Region) has been approved in principle.

With a view to expanding the Department's foreign technical aid programmes to French-speaking African states, an additional post of Assistant Agricultural Attaché to the Agricultural Counsellor, Paris, has been created with effect from 1 November 1971.

After careful investigation, the posts of Under-Secretary in the various Regional organisations, including those in the Division of Soil Protection and the Veterinary Services Branch, have been redesignated Assistant Director (Administrative) with effect from 1 November 1971.

The salary and post structure of the stock inspection group of the Division of Veterinary Services was revised on 1 February 1972 by the creation of posts of Control, Chief, Senior and Stock Inspector in the General B Division of the Civil Service.

As a result of the introduction of a combined training course for Soil Conservation and Extension Technicians, the linking of the two groups under the sub-heading Extension was authorised with effect from 1 February 1972.

Following a functional and establishment inspection, the Fruit and Food Technology Research Institute was redesignated the Fruit and Fruit Technology Research Institute with effect from 1 March 1972.

On 1 April 1972, control of the Lutzville experimental plots was transferred from the Winter Rainfall Region to the Oenological and Viticultural Research Institute, and the Plant Protection Research Institute took over control of the Rietondale Research Station from the Transvaal Region on 1 May 1972.

Under the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967, the Department had to provide suitable meat inspection posts at the abattoirs in Germiston, Benoni and Springs, which were taken over from the local authorities by the Abattoir Commission.

Personnel gains and losses (permanent, temporary and on contract)

Division	1.7.1970 – 30.6.1971			1.7.1971 – 30.6.1972		
	♠ Gains	Losses*	%	♠ Gains	Losses*	%
Administrative	3	9	– 300	7	11	– 57,1
Clerical	167	159	+ 4,8	166	162	+ 2,4
Professional	199	137	+ 31,2	187	195	– 4,3
Technical	254	206	+ 18,9	264	250	+ 5,3
General A	21	22	– 4,8	26	23	+ 11,5
General B	719	667	+ 7,2	688	737	– 7,1
Non-classified	99	86	+ 13,1	66	86	– 30,3
Total	1 462	1 286	+ 12	1 404	1 464	– 4,2

“Gains” here means all persons gained by every Division, in other words appointments from outside, promotions and translations from one Division to another and transfers from other Departments.

“Losses” here means all persons lost by the various Divisions (individually and jointly), including translations and promotions to other Divisions and cases where persons left the Services completely, for instance resignations, deaths, retirements, abscondences and dismissals.

Staff Changes (Senior Staff)

Retirements

After long terms of service, the following senior officers left the Department on reaching the age limit:

Name	Rank	Institution to which attached	Years of service	Date of leaving the Service
Dr P.W. Vorster	Secretary	Head Office	47 years	30 September 1971
Mr E.D. Adler	Chief Director	Directorate of Agricultural Technical Services	41 years	31 January 1972
Dr J.S. Watt	Director	South West Africa Region	42 years	31 August 1971
Mr J.A. van Rensburg	Director	Division of Agricultural Information	43 years	30 September 1971
Dr B.K. Petty	Director	Plant Protection Research Institute	42 years	31 October 1971
Mr J.A. Dreyer	Director	Highveld Region	37 years	31 January 1972
Dr M.C. Lambrechts	Director	Veterinary Services	35 years	31 March 1972
Mr J.P.J. van Vuren	Deputy Director	Head Office	12 years	29 February 1972
Mr M.S. Steyn	Assistant Director	Soil and Irrigation Research Institute	37 years	31 October 1971
Mr A.J. Viljoen	Assistant Director	Division of Soil Protection	36 years	31 March 1972
Dr W.O.D.M. Neitz	Assistant Chief	Veterinary Research Institute	42 years	30 November 1971

Transfers

The following senior staff were transferred during the year under review (transfers on promotion are not included):

Name	Rank	Transferred from —	Transferred to —	Date of transfer
Dr J.'Serfontein	Deputy Director	Professional Auxiliary Services Panel.	Division of Soil Protection	1 January 1972
Dr P. Hildyard	Deputy Director	Professional Auxiliary Services Panel	Washington, as Agricultural Counsellor	29 February 1972
Mr J.J. van der Merwe	Assistant Director	Crops and Pastures Institute	Transvaal Region	1 July 1971
Mr P.F.H. Clarke	Assistant Director	Professional Auxiliary Services Panel	Crops and Pastures Institute	1 February 1972
Mr D.J. van Z. Smit	Assistant Director	Transvaal Region	Winter Rainfall Region	4 April 1972
Dr G.C. van Drimmelen	Assistant Director	Washington (Agricultural Counsellor)	Division of Veterinary Services	7 April 1972

Promotions

Name	Rank to which promoted	Institution	Date of promotion
Dr W.A. Verbeek	Secretary for Agricultural Technical Services	Head Office	1.10.1971
Mr W. van der Merwe	Senior Deputy Secretary	Head Office	1.10.1971
Dr D.W. Immelman	Chief Director: Farm and Resources Development	Directorate of Agricultural Technical Services	1.11.1971
Mr S.W. Walters	Chief Director: Extension and Regulatory Services	Directorate of Agricultural Technical Services	1. 2.1972
Dr P.R. Mansvelt	Director	Division of Veterinary Services	1. 4.1972
Mr F.J. Rosenstrauch	Director	Division of Agricultural Information	1.10.1971
Dr J.E. Erasmus	Director	Winter Rainfall Region	1.10.1971
Dr J.J. du Toit	Director	Plant Protection Research Institute	1.11.1971
Dr I.H. Wiese	Director	Plant Protection Research Institute	1.11.1971
Dr M.C.F. du Plessis	Director	Soil and Irrigation Research Institute	1. 2.1972
Mr L.F. Whitlock	Director	Eastern Cape Region	1. 2.1972
Dr D.J. Agenbach	Director	Highveld Region	1. 2.1972
Dr T. Veenstra	Deputy Director	Division of Veterinary Services	1. 4.1972
Mr W.S. Grobbelaar	Deputy Director	O.F.S. Region	1. 8.1971
Mr E.C. Andersen	Deputy Director	Transvaal Region	1. 8.1971
Dr P. Hildyard	Deputy Director (Research)	Highveld Region	1. 8.1971
Dr P.E. Lombard	Deputy Director (Research)	Transvaal Region	1. 8.1971
Dr P.W. Roux	Deputy Director (Research)	Karoo Region	1. 8.1971
Mr R.H. Peard	Deputy Director (Extension)	Natal Region	1. 8.1971
Mr J.H. Stapelberg	Deputy Director (Research)	Eastern Cape Region	1. 8.1971
Dr J. Serfontein	Deputy Director	Professional Auxiliary Services Panel	1. 8.1971
Mr D.F. de Wet	Deputy Director (Crops and Pastures Institute)	Crops and Pastures Institute	1. 8.1971
Dr J.G. Boyazoglu	Deputy Director (Research)	Agricultural Counsellor, Paris	1. 8.1971
Mr J. de V. Burger	Deputy Director (Oenology and Viticulture)	Oenological and Viticultural Research Institute	1. 8.1971
Dr J.M. de Villiers	Deputy Director	Soil and Irrigation Research Institute	1. 8.1971
Dr P.J.S. Pieterse	Deputy Director (Research)	Winter Rainfall Region	1.10.1971

Mr R.J. van Niekerk	Deputy Director (Agricultural Information)	Division of Agricultural Information	1.10.1971
Mr A. Viljoen	Deputy Director (Extension)	Winter Rainfall Region	1. 2.1972
Dr E.O. le Riche	Assistant Director	Division of Veterinary Services	1. 4.1972
Dr B.W. Strydom	Assistant Director	Plant Protection Research Institute	1.11.1971
Mr H.G. Snyman	Assistant Director (Research)	Tobacco Research Institute	1. 9.1971
Dr E. le F. Terblanche	Assistant Director (Extension)	Eastern Cape Region	1. 9.1971
Dr J.P. Jooste	Assistant Director	Professional Auxiliary Services Panel	1. 9.1971
Mr J. Myburgh	Assistant Director (Soil and Irrigation Research Institute)	Seconded to the Department of Agricultural Credit and Land Tenure	1.11.1971
Mr J.J. Lutz	Assistant Director (Crops and Pastures Institute)	Crops and Pastures Institute	1.11.1971
Dr J.G. Cloete	Assistant Director (Animal and Dairy Science Research Institute)	Animal and Dairy Science Research Institute	1.12.1971
Mr T.E. Skinner	Assistant Director	Crops and Pastures Institute	1. 1.1972
Mr G.P. Kleinhans	Chief Work Study Officer	Division of Work Study	1. 2.1972
Dr A.J. Siepker	Assistant Director	Division of Soil Protection	1. 5.1972

The following officers have been promoted to a personal salary scale

Promoted to a personal salary scale equivalent to that of Secretary

Name	Rank	Institution	Date of promotion
Dr B.C. Jansen	Chief Director	Veterinary Services Branch	1. 7.1971

Promoted to a personal salary scale equivalent to that of Assistant Director

Name	Rank	Institution	Date of promotion
Dr S.W. Broodryk	Chief Professional Officer (Entomology/Zoology)	Plant Protection Research Institute	1. 8.1971
Dr G.D. Sutton	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr W.C. Viljoen	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr J.A. Schutte	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr D.B.V. Barrow	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr W.P. van Aardt	State Veterinarian	Veterinary Research Institute	1. 9.1971
Dr T.C.W. Wessels	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr R.J. Bezuidenhout	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr I.S. Watt	State Veterinarian	Division of Veterinary Services	1. 9.1971
Dr A.P. Schutte	State Veterinarian	Veterinary Research Institute	1.11.1971
Dr E.M. van Tonder	State Veterinarian	Division of Veterinary Services	1.12.1971
Dr L. Coetzee	State Veterinarian	Veterinary Research Institute	1. 1.1972
Dr A.M. Schmidt-Dumont	State Veterinarian	Division of Veterinary Services	1. 1.1972
Dr E. Young	State Veterinarian	Division of Veterinary Services	1. 1.1972

Death

The Department regrets the death, on 1 August 1971, of Professor I.S. Perold, Director of the Winter Rainfall Region, and one of its ablest officers.

A man of many years' experience and remarkable dedication, Professor Perold's services to the Department and to the country and its people were of outstanding value. He will long be remembered, particularly for his contribution in the fields of biochemistry and agricultural chemistry.

Bursaries

The bursary scheme administered by the Department with funds granted by the various Control Boards, was continued during 1971/72. Bursaries are granted for the full period of study, which may vary from one to five years.

The number of bursaries for post-graduate study at local universities up to and including 1972 is included in the above table. During 1972 two bursaries to the value of R3 200 were granted for post-graduate study at local universities.

As far as advanced scientific training is concerned, a number of promising officers are studying overseas. The number of officers sent overseas for post-graduate study is still decreasing

An amount of R1 845 has been granted to twelve needy students taking the diploma course at the various agricultural colleges.

Training of Agricultural Technicians

The training of Learner Technicians was continued with great success during the past year. A refresher course for Extension Technicians in certain soil conservation subjects was also arranged. The course was attended by 55 Extension Technicians who had followed the old separate course for Extension Technicians.

The following table shows the number of bursaries granted since 1962, as well as their total monetary value:

	Number of bursaries		Studies completed	Total monetary value of new bursaries granted
	New grants	Total		
Grants up to 1962	—	75	—	R100 200
Grants up to 1963	29	93	31	R 42 400
Grants up to 1964	46	108	32	R 47 400
Grants up to 1965	38	107	27	R 45 800
Grants up to 1966	51	131	40	R 55 800
Grants up to 1967	45	141	35	R 52 000
Grants up to 1968	55	161	33	R 80 650
Grants up to 1969	29	157	31	R 40 200
Grants up to 1970	27	153	44	R 56 400
Grants up to 1971	29	138	23	R 61 600
Grants up to 1972	34	149	25	R 59 200

The following table shows the number of officers released from duty for post-graduate study at local universities since 1959:

Year	1959—1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
B. Agric. (Hons)	—	—	—	—	21	14	16	11	8	8	14
(Inst. Agrar.)	88	52	145	111	149	70	35	25	37	47	40
Master's degree	—	—	1	2	6	5	1	—	—	—	—
Doctorate	—	—	—	—	—	—	—	—	—	—	—

The following table shows the number of officers who have completed their overseas studies or will soon do so

Year	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Number	26	19	21	12	14	4	15	3	4	4	5

The following tables show the number of Learner Technicians who were busy with their theoretical training during the year under review:

	New admissions		Second year		Third year	
	Second Semester 1971	First Semester 1972	Second Semester 1971	First Semester 1972	Second Semester 1971	First Semester 1972
Soil Conservation and Extension	40	—	—	37	—	—
<i>Agricultural Economics and Marketing</i>						
Zoology	7	—	—	6	—	—
Botany	14	—	—	13	—	—
<i>Researchers</i>						
Zoology	—	7	8	—	—	6
Botany	—	7	7	—	—	7
<i>Inspection</i>						
Zoology	3	—	—	2	—	—
Botany	17	—	—	16	—	—
Chemistry	—	2	1	—	Not offered	2
Microbiology	4	3	6	3	4	5
Drawing, Civil Engineering	2	2	2	1	—	2
Agricultural Mechanisation	1	4	—	1	1	—
Surveying, Topography	—	—	1	1	—	—
	88	25	25	80	5	22

Programmed Course

Course	Second Semester 1971	First Semester 1972
Soil Conservation and Extension	29	—
<i>Agricultural Economics and Marketing</i>		
Zoology	4	—
Botany	7	—
<i>Inspections</i>		
Zoology	1	—
Botany	14	—
	55	—

10. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE OF THE DEPARTMENT

Agriculture Building, cr. Beatrix Street and
Soutpansberg Road, Private Bag X116, Pretoria

Overhead Administrative Control

Secretary – Dr W.A. Verbeek
Senior Deputy Secretary (Professional) – Mr W. van der Merwe
Senior Deputy Secretary (Administrative) – Mr J.A. Booyens
Deputy Secretary (Personnel and General) – Mr J.S. Pretorius
Deputy Secretary (Technical and Legal Affairs) – Mr C.B. Balt
Under-Secretary (Personnel) – Mr A.J. Schoonwinkel
Under-Secretary (Auxiliary Services) – Mr R.W. Colenbrander
Chief Work Study Officer – Mr G.P. Kleinhans
Under-Secretary (Technical Affairs) – Mr B.W. Viljoen
Under-Secretary (Technical Relations) – Mr L.J. Botha
Under-Secretary (Legal Affairs) – Mr C.J. Wessels
Chief Accountant – Mr A.N. Redelinghuys
Assistant Chief Accountant – Mr P.L. Joubert

Directorate of Agricultural Technical Services

Chief Director (Crops and Pastures) – Professor S.A. Hulme
Chief Director (Farm and Resources Development) – Dr D.W. Immelman
Chief Director (Horticulture) – Dr J.C. Strydom
Chief Director (Animal and Dairy Science) – Dr C.M. van Wyk
Chief Director (Extension and Regulatory Services) – Mr S.W. Walters

Veterinary Services Branch

Chief Director (Veterinary Services) – Dr B.C. Jansen
Assistant Director (Administrative) – Mr P.O.C. Gillingham (Transvaal Agricultural Union Building, 281 Struben Street, Pretoria)

Panel Professional Auxiliary Services

Director – Professor D.M. Joubert
Deputy Director (Biometry) – Mr C.M. Havenga
Assistant Director (Biometry) – Dr J.P. Jooste
Assistant Director (Training) – Vacant
Assistant Directors (General Auxiliary Services): Mr A.B. Bridgens, Mr P.F. Clarke, Mr J.G. Low and Dr H.L. Pearse

Crops and Pastures Institute

Director – Professor A.J. Pienaar
Deputy Director – Mr D.F. de Wet
Assistant Directors: Dr W.P. Grobbelaar, Dr D.J. Roussouw and Mr J.E. Skinner

The Institute does not itself engage in research but gives guidance to research workers engaged in research in the different regions on summer grain, winter grain, other agricultural crops, pastures and pasture crops, and co-ordinates all research in this connection.

Departmental Inspectorate

Departmental Inspector (Professional) – Vacant
Departmental Inspector (Professional) – Mr H.J. Kriek
Departmental Inspector (Professional) – Vacant

(b) FOREIGN REPRESENTATIVES

Agricultural Attaché (London) – Dr J.P. Botha (Agricultural Counsellor) (South African Embassy, South Africa House, Trafalgar Square, London W.C. 2N5DP, England)
Agricultural Attaché (Paris) – Dr J.G. Boyazoglu (Agricultural Counsellor) (South African Embassy, 51 Ave Hoché, Paris 8e, France)
Agricultural Attaché (Washington) – Dr P. Hildyard (Agricultural Counsellor) (South African Embassy, 3051 Massachusetts Avenue, Washington D.C. 20008, U.S.A.)
Agricultural Attaché (Buenos Aires) – Mr J.C.D. Retief (South African Embassy, Cerrito 550-60 Piso, Buenos Aires, Argentina)

(c) RESEARCH INSTITUTES

Soil and Irrigation Research Institute,
Belvedere Street, Private Bag X79, Pretoria

Director – Dr M.C.F. du Plessis
Deputy Director (Chemical Analysis and Regulatory Services) – Dr J.M. de Villiers

Deputy Director (Irrigation Research, Agricultural Meteorology and Agricultural Land Development) — Dr A.D. Nieuwoudt

Assistant Directors: (Chemical analysis and Regulatory Services) — Dr C.E.G. Schutte; (Soil Survey) H.J. von M. Harmse; (Irrigation Research) — Dr P.F. Fuls; (Agricultural Meteorology) — Dr M.E.L. Buys; (Agricultural Land Development) — Mr J.J. Lutz

The Institute is responsible for the classification and mapping of the soils of the Republic, as well as for basic research at national level in respect of the physical and chemical characteristics of soils. In addition, soil surveys are undertaken for irrigation projects and the investigation of physical soil characteristics where brack and waterlogging conditions occur. The Institute, on behalf of other Government departments, provincial administrations and other bodies, also undertakes the chemical analysis of soil, water and plant material. Furthermore, the Institute, in terms of Act 36 of 1947, undertakes the inspection and analysis of fertilisers, stock feeds, stock remedies and agricultural remedies. The Institute is responsible for the planning, co-ordination and control of irrigation research carried out by and/or in co-operation with the Regions and Institutes and has also been designated to undertake agricultural evaluations and planning of irrigation areas. Another task of the Institute is the collection, processing and interpretation of meteorological data for agricultural purposes.

Plant Protection Research Institute,
Agriculture Building, Beatrix Street,
Private Bag X134, Pretoria

Director — Dr J.J. du Toit
Deputy Director — Dr I.H. Wiese
Assistant Director — Dr D.P. Annecke
(Entomology/Zoology) and Dr B.W. Strydom
(Plant Pathology/Microbiology)

The Institute is broadly responsible for advanced research and research at the national level on plant pathology, insect and animal pests and their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagating material from viruses, bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests. The Institute also undertakes locust research. The research stations and experimental farms Buffelspoort (Marikana), Fleurbaix (Stellenbosch) and research

units for the control of prickly pear and jointed cactus at Uitenhage and forest pests at Rosebank (Cape Town) are used by this Institute.

Botanical Research Institute,
590 Vermeulen Street, Pretoria

Director — Dr L.E.W. Codd
Deputy Director — Dr B. de Winter
Assistant Director — Dr D.J.B. Killick

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanical Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute,
Private Bag 11208, Nelspruit

Director — Dr J.H. Grobler
Deputy Director — Mr A. van Oostrum
Assistant Director — Dr D.L. Milne

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs. The Institute also undertakes research on the research stations and experimental farms Addo (Eastern Cape), Burgers Hall, Citrusdal, East London, Friedenheim, Levubu (Louis Trichardt), Messina, and Rustenburg.

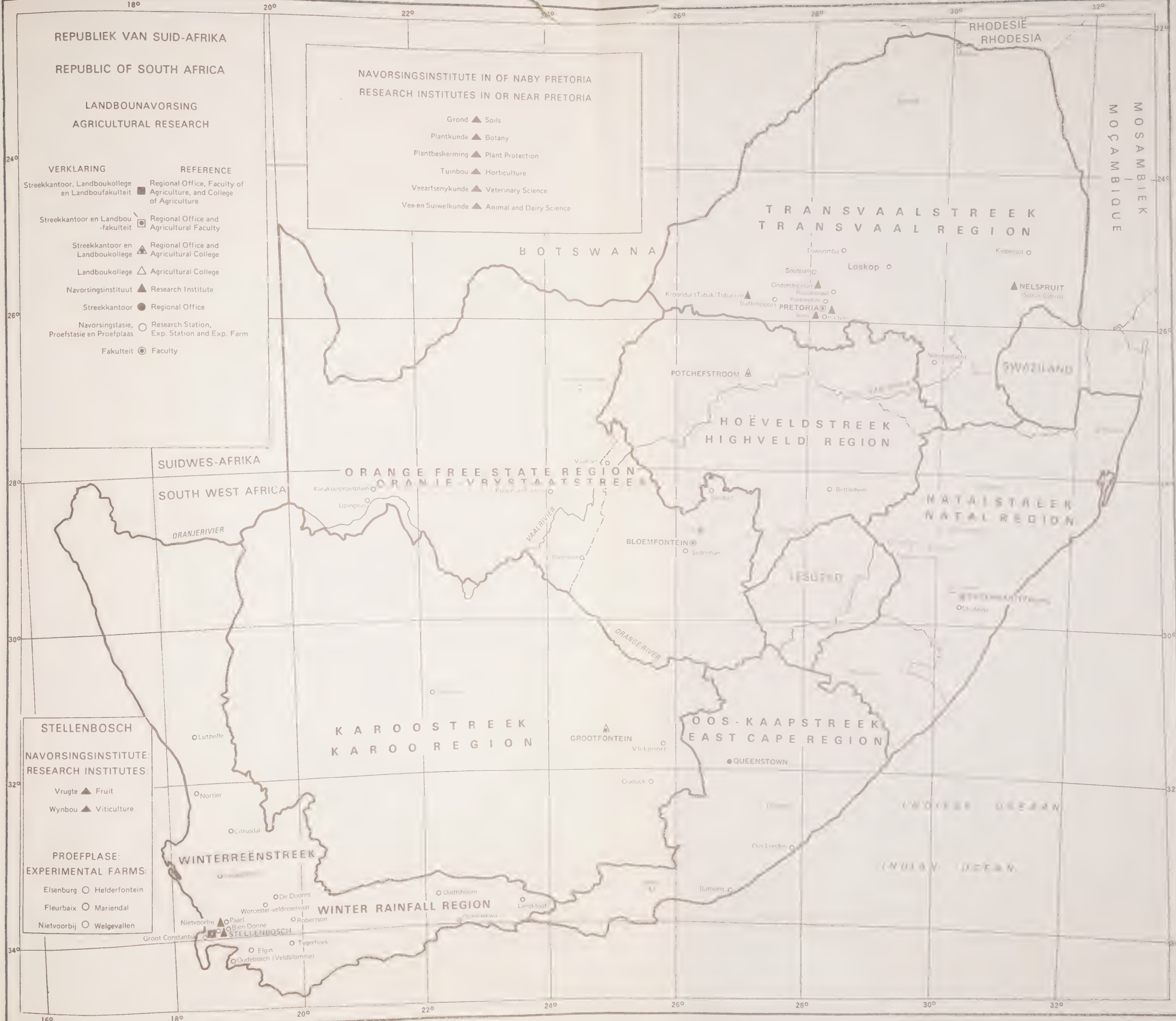
Tobacco Research Institute (Kroondal),
Private Bag, Rustenburg

Director — Mr J.F. Peens
Deputy Director — Mr H.G. Snyman (Assistant Director)
Assistant Director — Dr M.P. Lamprecht

The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research stations and experimental plots at Groblersdal, Hartebeespoort (Brits), Nelspruit, Potgietersrus and Stellenbosch.

Horticultural Research Institute (Roodeplaat),
Private Bag X293, Pretoria

Director — Mr E. Strydom
Deputy Director — Dr J.T. Meynhardt
Assistant Director — Mr T.G. la G. Joubert



REPUBLIC VAN SUID-AFRIKA

REPUBLIC OF SOUTH AFRICA

LANDBOUNAVORSING
AGRICULTURAL RESEARCH

NAVORSINGSINSTITUTE IN OF NABY PRETORIA
RESEARCH INSTITUTES IN OR NEAR PRETORIA

- Grond ▲ Soils
- Plantkunde ▲ Botany
- Plantbeskerming ▲ Plant Protection
- Tuinbou ▲ Horticulture
- Veeartsenykunde ▲ Veterinary Science
- Vee-en Suiwelkunde ▲ Animal and Dairy Science

VERKLARING

- Streekkantoor, Landboukollege en Landboufakulteit
- Streekkantoor en Landbou-fakulteit
- Streekkantoor en Landboukollege
- Landboukollege
- Navorsingsinstituut
- Streekkantoor
- Navorsingstasie, Proefstasie en Proefplaas
- Fakulteit

REFERENCE

- Regional Office, Faculty of Agriculture, and College of Agriculture
- Regional Office and Agricultural Faculty
- Regional Office and Agricultural College
- Agricultural College
- Research Institute
- Regional Office
- Research Station, Exp. Station and Exp. Farm
- Faculty

SUIDWES-AFRIKA

SOUTH WEST AFRICA

ORANJERIVIER

ORANGE FREE STATE REGION
ORANIE VRYSTAATSTREEK

- Karakoulproefplaas
- Uppingham
- Koosje and Jansje
- Paarl
- Paarlse

VAALRIVIER

BLOEMFONTEIN

Bethlehem

ORANGE RIVER

KAROOSTREEK
KAROO REGION

GROOTFONTEIN

OOS-KAAPSTREEK
EAST CAPE REGION

QUEENSTOWN

Craddock

STELLENBOSCH

NAVORSINGSINSTITUTE:
RESEARCH INSTITUTES:

- Vrugte ▲ Fruit
- Wynbou ▲ Viticulture

PROEFPLASE:
EXPERIMENTAL FARMS:

- Elsenburg
- Helderfontein
- Fleurbaix
- Mariendal
- Nietvoorbij
- Welgevallen

WINTERREËNSTREEK

WINTER RAINFALL REGION

- Groot Constantia
- Nietvoorbij
- Paarl
- Paarlse
- Robertson
- Worcester-veldreservaat
- De Doorns
- Tygerhoek
- Elgin
- Oudebosch (Veldblomme)

RHODESIE
RHODESIA

MOSAMBIEK
MOÇAMBIQUE

TRANSVAALSTREEK
TRANSVAAL REGION

Townsmo

Loskop

Kiepersol

Soutpanjo

Onderstepoort

Roosburg

Buffelspoort

- Pretoria

NELSPRUIT
(Sintus Citrus)

POTCHEFSTROOM

Norvalledacht

SWAZILAND

HOËVELDSTREEK
HIGHVELD REGION

NATALSTREEK
NATAL REGION

ISURID

STELLENBOSCH

Oudebosch

INDIAN OCEAN

INDIAN OCEAN

The Institute is responsible for research and professional extension on deciduous fruit and table grapes in the summer rainfall regions as well as for research throughout the Republic on vegetables, ornamental plants, cut flowers and shrubs. The Institute also controls the experimental station for cherry and deciduous fruit research at Emperani, near Ficksburg and conducts vegetable research in the Winter Rainfall Region at Elsenburg, Lutzville and Outeniqua, in the Free State at Glen, in the Lowveld at Nelspruit and in Natal at Cedara. Research on indigenous flowers is undertaken at the Oude-Bos Experimental Station, near Elgin.

**Veterinary Research Institute,
Onderstepoort, Pretoria**

Director – Dr K.E. Weiss

Deputy Directors:

(Virus Diseases, Bacterial and Protozoic Diseases, Parasitology and Chemistry) – Dr M. de Lange
(Pathology, propagation, and Professional Technical Auxiliary Services) – Dr J.D. Smit

Assistant Directors:

(Protozoology and Parasitology) – Dr R.D. Bigalke
(Virus Diseases and Molecular Biology) – Dr D.W. Verwoerd
(Chemistry) – Dr R.A. Oellermann
(Pathology) – Vacant
(Bacterial Diseases and Diagnostics) – Dr T.F. Adelaar
(Toxicology) – Dr T.W. Naudé

The Institute undertakes research on stock diseases (infectious and other including diseases caused by malnutrition), diagnostics, the preparation of vaccines and remedies, and the biological evaluation of dips and remedies submitted for registration. The academic activities of the Faculty of Veterinary Science of the University of Pretoria are closely linked with the activities of the Institute.

**Animal and Dairy Science Research Institute,
Poynton Building, West Block, 9th Floor, Church Street,
Private Bag X177, Pretoria**

Director – Dr J.H. Hofmeyr

Deputy Director (Livestock Improvement, Animal Physiology and Nutrition, and Poultry Science) – Dr G.B. Laurence (Assistant Director)

Deputy Director (Dairy Science) – Dr J.C. Oosthuisen

Assistant Directors:

(Livestock Improvement) – Mr J.S.A. Landrey
(Animal Physiology and Nutrition) – Dr J.G. Cloete
(Poultry Science) – Mr W.J.C. Viljoen
(Dairy Science) – Dr J.H. Labuschagne

The Institute, at various centres throughout the country, undertakes performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig testing stations at Irene, Cedara and Elsenburg, and bull testing stations at Queenstown and Omatjenne.

**Fruit and Food Technology Research Institute,
Private Bag, Stellenbosch, C.P.**

Director – Dr P.G. Marais

Deputy Director – Dr A.J. Heyns

Assistant Directors:

(Table Grapes, Horticulture, Plant Improvement, Plant Pathology and Entomology) – Dr A.C. Myburgh;
(Chemistry, Cold Storage, Plant Biochemistry, Fruit Processing, Radio Isotopes) – Dr W.J. Pienaar

The Institute is responsible for research on deciduous fruits, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products assigned to it. The Institute further renders a radiation and radio-isotopic service in connection with agricultural problems in the winter rainfall complex.

**Oenological and Viticultural Research Institute,
Private Bag, Stellenbosch, C.P.**

Director – Dr J.A. van Zyl

Deputy Director – Dr J. de V. Burger

Assistant Director – Mr M.S. le Roux

The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The Institute also controls the historic wine farm Groot Constantia.

(d) DIVISIONS

Soil Protection, (Agriculture Building),
Beatrix Street, Private Bag X120, Pretoria

Director — Mr E.J.J. van der Horst

Deputy Director (Regulatory Control) — Dr J. Serfontein

Assistant Director (Land Subdivision and Weed Control)
— Dr A.J. Siepker

Assistant Director (Administrative) — Mr B.J. Dreyer

The Division is responsible for the administration of the Soil Conservation Act (Act no. 76 of 1969), the Weeds Act (Act no. 42 of 1937), and the Subdivision of Agricultural Land Act (Act no. 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Agricultural Engineering,
Creswell Road, Koedoespoort, Private Bag X280,
Pretoria

Director — Mr J.J. Bruwer

Chief Engineers:

(Regional Services and Soil Conservation) — Mr N.J. van Straaten

(Research Civil and Irrigation, Testing and Research Mechanical, and Utility Services) — Mr C.T. Crossby

(Regional Engineering Services, Stellenbosch) — Mr J.F. la G. Matthee

Assistant Chief Engineers:

(Soil Conservation Works, Pretoria) — Mr P.J. Pienaar

(Research Civil and Irrigation, Pretoria) — Mr I. Scheepers

(Testing and Research Mechanical, Pretoria) — Mr J. Veenstra

This Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Agricultural Information,
Agriculture Building, Beatrix Street,
Private Bag X144, Pretoria

Director — Mr F.J. Rosenstrauch

Assistant Director (Publications) — Mr D.B. Marais
(Deputy Director)

Assistant Director (Information) — Mr R.J. van Niekerk,
(Deputy Director)

The function of the Division is the distribution of agricultural information by mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Plant Pest Control,
Craigielea Building, 698 Church Street East,
Private Bag X232, Pretoria

Director — Mr E.H.W. Lochner

Deputy Director — Mr D.C. Lourens

Assistant Director (Prevention Services) — Mr A.C. Nel

Assistant Director (Control Services) — Mr I.G. Venter
(Chief Professional Officer)

To ensure that only healthy and insect-free plants are imported, grown or distributed, the Division exercises phytosanitary control over the importation and distribution of plants, vegetative propagation material and seed, and is responsible for the registration and inspection of nurseries and the certification of seed potatoes. It also undertakes surveys and locust control studies and, when necessary, launches campaigns against locusts. In addition the Division conducts experiments in connection with red-billed finches and, when necessary, undertakes control measures over the plague.

Division of Seed Control,
Agricultural Building, Hamilton Street,
Private Bag X179, Pretoria

Director — Mr J.F. van Wyk

Assistant Director — Mr J.J. Lowes

The Division controls all matters relating to seed quality, including land and related inspections for the certification of seed, and is responsible for importing and exporting of seed and vegetative propagation material for official purposes from and to virtually every country in the world. The Division administers the Seed Act (No. 28 of 1961), the Foundation Seed Act (No. 29 of 1961) and the Plant Breeders' Rights Act (No. 22 of 1964).

Division of Veterinary Services,
Transvaal Agricultural Union Building, 281 Struben
Street, Private Bag X138, Pretoria

Director — Dr P.R. Mansvelt

Deputy Directors:

(Regulatory Services) — Dr J.P. van der Merwe
(Pretoria)
(Health Services) — Dr J.H.B. Viljoen (Pretoria)
(Veterinary Services — South West Africa) — Dr T.
Veenstra (Windhoek)
(Diagnostic Services) — Dr G.C. van Drimmelen
(Pretoria)
(Meat Hygiene and Related Matters) — Dr C.W.A.
Belonje (Pretoria)
(Import and Export Control and Border Control)
Dr E.B. Kluge (Pretoria)
(Notifiable Diseases, Major Disease Eradication
Schemes, Extension and Training) — Dr A. van
Heerden (Pretoria)
(Bantu Veterinary Services) — Dr J.M. Erasmus
(Pretoria)
(Highveld Region) — Dr P.P. Hugo
(Potchefstroom)
(Natal Region) — Dr L.W. Rossiter
(Pietermaritzburg)
(Eastern Cape and Karoo Region) — Dr J.M. de
Wet (East London)
(Eastern Transvaal Region) — Dr L.R. Hurter
(Pietersburg)
(Transvaal Region) — Dr F.W.B. du Casse
(Pretoria)
(Free State Region) — Dr T.A.T. Louw
(Bloemfontein)
(Winter Rainfall Region) — Dr E.O. le Riche
(Stellenbosch)
(S.W.A. North) — Dr W.H.B. Bühr (Windhoek)
(S.W.A. South) — Dr J.D. Coetzee (Windhoek)

The Assistant Directors of the Regions are under the
direct control of the Director.

The Division is responsible for animal health in
accordance with prescribed legislation. In the first
instance, by erecting, patrolling and maintaining
game- and cattle-proof fences on the borders of
the Republic and South West Africa and
controlling animal imports in order to guard
against the introduction of diseases. Secondly,
regular inspections of all stock are carried out for
domestic protection. The promotion of
disease-eradication schemes and animal health in
general has recently been given high priority.

Apart from the central diagnostic laboratory at
Onderstepoort, the Division has a number of
diagnostic centres throughout the Republic and
South West Africa for local investigation of stock
losses and problems relating to animal health and

sub-optimal production and reproduction. The
Division also administers the Animal Slaughter,
Meat and Animal Products Hygiene Act of 1967.

(e) REGIONAL ORGANISATIONS

The seven Regional Organisations of the Republic, as
well as of South West Africa, are responsible,
within their respective geographical areas, for the
planning, development, promotion and application
of farming systems based on optimal land
utilisation.

Each of these organisations provides an extension service
in which the soil conservation effort is integrated
and which also covers every aspect of farming. The
research services are directed to the collation and
releasing of scientific knowledge for the optimal
utilisation of the natural agricultural resources.
The research personnel are also responsible for
specialist extension work and for supplying
training services to the agricultural colleges.

Highveld Region,
Private Bag 804, Potchefstroom

Director — Dr D.J. Agenbach
Deputy Director (Research) — Mr J.H. Preller (Assistant
Director)
Assistant Director (Research) — Mr J.D. Basson
Deputy Director (Extension) — Dr F.J. Kok
Assistant Director (Extension) — Mr R.W. Nott
College — Potchefstroom College of Agriculture
Research Stations and experimental farms:
Potchefstroom Complex (central research station),
Bethlehem and Swartrand (for gousiekte research)
at Ventersdorp.

Karoo Region,
Grootfontein Agricultural College, Middelburg, C.P.

Director — Dr W.J. Hugo
Deputy Director (Research) — Dr P.W. Roux
Assistant Director (Research) — Mr J.A.A. Baard
Deputy Director (Extension) — Mr J.J.S. Cilliers
Assistant Director (Extension) — Mr C.R. Baard
College — Grootfontein College of Agriculture
Research stations and experimental farms: Grootfontein,
Middelburg, C.P. (central research station),
Carnarvon and Tarka Conservation Area.

Natal Region,
Private Bag 9021, Pietermaritzburg

Director — Mr L.C. Zeeman
Deputy Director (Research) — Prof. G.O. Harwin
Assistant Director (Research) — Dr J.W.C. Mostert
Deputy Director (Extension) — Mr R.H. Peard
Assistant Director (Extension) — Mr H.S. Niehaus
Assistant Director (Administrative) — Mr D.E. Foster
Faculty — Faculty of Agriculture, University of Natal
College — Cedara College of Agriculture
Research stations and experimental farms: Cedara
(central research station), Drakensberg Complex,
Dundee, Estcourt, Kokstad, Makatini and Pongola
Bushveld Farm.

Eastern Cape Region,
P.O. Box 233, Queenstown

Director — Mr L.F. Whitlock
Deputy Director (Research) — Mr J.H. Stapelberg
Assistant Director (Research) — Mr J.L. van der Walt
Deputy Director (Extension) — Vacant
Assistant Director (Extension) — Dr E. le F. Terblanche
Research stations: Döhne (central research station) at
Stutterheim, and Bathurst (Port Alfred). A
number of experiments are also conducted at East
London.

Transvaal Region,
Agrivaal Building, cr. Edmund and Hamilton
Streets, Private Bag X180, Pretoria

Director — Prof. F.R. Tomlinson
Deputy Director (Research) — Dr P.E. Lombard
Assistant Director (Research) — Mr J.J. van der Merwe
Deputy Director (Extension) — Mr E.C. Anderssen
(Assistant Director)
Assistant Director (Extension) — Mr S.J. Gericke
Assistant Director (Administrative) — Mr T. Brenkman
Faculty — Faculty of Agriculture, University of Pretoria
Research stations and experimental farms: Roodeplaat
(central research station), Pretoria University
Experimental Farm, Rietondale, Rietvlei and
Soutpan (Pretoria); Athole (Amsterdam),
Barberton, Loskop (Groblersdal), Losperfontein
(Brits), Mara (Louis Trichardt), Messina,
Nooitgedacht (Ermelo), Sterkrivier (Potgietersrus)
and Towoomba (Warm Baths).

Free State Region,
Agricultural College, Glen

Director — Dr S.W. Pienaar
Deputy Director (Research) — Mr W.S. Grobbelaar
Assistant Director (Research) — Dr P.J. Niemann
Deputy Director (Extension) — Dr J.D. Slabber
Assistant Director (Extension) — Mr C.W. Oosthuyzen
Assistant Director (Administrative) — Mr J.C. Jacobs
Faculty — Faculty of Agriculture, University of the
Orange Free State, Bloemfontein
College — Glen College of Agriculture
Research stations and experimental farms: Glen (central
research station), Armoedsvlakte (Vryburg),
Koopmansfontein (Barkly West), Rietrivier
(Herbert), Sandvet, Sydenham, Upton Complex
and Vaalharts (Jan Kempdorp)

Winter Rainfall Region,
J.S. Marais Building, Private Bag 5023, Stellenbosch

Director — Dr J.E. Erasmus
Deputy Director (Research) — Dr P.J.S. Pieterse
Assistant Director (Research) — Mr J.E. van Niekerk
Deputy Director (Extension) — Dr D.J. Agenbach
Assistant Director (Extension) — Mr A. Viljoen
Assistant Director (Administrative) — Mr H.C. du Preez
Faculty — Faculty of Agriculture, University of
Stellenbosch
College — Stellenbosch-Elsenburg College of Agriculture
Research stations and experimental farms: Elsenburg,
Mariendal and Welgevallen (Stellenbosch),
Langgewens (Moorreesburg), Lutzville, Nortier
(Lambert's Bay), Oudtshoorn, Outeniqua
(George), Tygerhoek (Riviersonderend) and the
Veld Reserve at Worcester.

South West Africa,
Private Bag 13184, Windhoek

Director — Mr D.J. Louw
Deputy Director (Research) — Mr L. Mostert
Deputy Director (Extension) — Mr J.H. Loubser
College: Neudam Agricultural College
Research stations and experimental farms: Gellap 'Ost
(Keetmanshoop), Hardap (Mariental), Kalahari
(Stampriet), Neudam (Windhoek), Omatjenne
(Otjivarongo), Sandveld (Gobabis), Sonop
(Grootfontein), Uitkomst (Grootfontein).

(2) AGRICULTURAL EDUCATION

(a) Pregraduate and postgraduate students in Agriculture, 1971 and 1972

University	2nd year		3rd year		4th year		B.Sc. Hon.		M.Sc.		D.Sc. & Ph.D		Total	
	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972
Pretoria	67	76	48	48	48	56	9	11	67	79	56	38	295	308
Stellenbosch	106	—	42	121	56	42	26	31	49	46	30	21	309	261
Natal	41	28	45	40	52	43	—	—	37	42	12	20	187	173
Orange Free State	33	*27	32	**34	30	22	10	15	17	11	33	32	155	141
Total	247	131	167	243	186	163	45	57	170	178	131	111	946	883

Total for non-final year students and includes 49 B.Agric students

* Includes 3 B.Agric students

** Includes 11 B.Agric students

(b) Pregraduate and postgraduate students in Agricultural Engineering, 1971 and 1972

University	1st year		2nd year		3rd year		4th year		Hons & M.Sc.		D.Sc.		Total	
	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972
Pretoria	10	15	12	13	3	10	13	9	7	4	1	1	46	52
Stellenbosch	—	—	—	—	1	*4	3	3	4	1	—	—	8	8
Natal	14	10	4	5	3	3	3	3	—	1	—	—	14	22
Total	14	25	16	18	7	17	19	15	11	6	1	1	68	82

Total for non-final year students

(c) Pregraduate and postgraduate students in Veterinary Science, U.P., 1971 and 1972

1st year		2nd year		3rd year		4th year		5th year		5½ year		M.Med. Vet.		D.V.P.H.		D.V.Sc.		Total	
1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972
115	119	44	46	50	48	46	51	38	41	3	3	38	49	2	4	8	14	344	375

(d) Students who graduated at the end of 1970 and 1971

	B.Sc. & B.V.Sc.		Honours Degree		Master's Degree		Doctor's Degree		Total	
	1970	1971	1970	1971	1970	1971	1970	1971	1970	1971
Agriculture	176	165	42	39	44	49	18	12	280	
Agricultural Extension	—	—	9	9	2	2	—	1	11	12
Agricultural Engineering	1	10	—	—	—	—	—	—	1	10
Veterinary	42	36	—	—	2	2	2	—	46	38
Total	219		51		48		20		338	

(3) FINANCES

(a) REVENUE (REPUBLIC)

	R	R	R
1. Rentals from houses			138 459,98
2. Interest			11 474,16
3. Recoveries of loans			185,95
4. Departmental receipts			
Administration and general			
(a) Registration fees	104 057,02		
(b) Commission on insurances	7 854,71	111 911,73	
Vaccines		955 233,34	
Goods and services		1 581 741,23	
Publications		67 986,56	
5. Miscellaneous revenue			
(a) Refund on voted expenditure	127 717,95		
(b) Sale of State property	77 738,31		
(c) Unclaimed cash	13 895,60		
(d) Miscellaneous	95 914,28	315 266,14	3 032 139,00
GRAND TOTAL			
6. Interest on Tobacco Research Account			20 142,15
7. Interest on Wine Research Account			6 103,83
8. Interest on Agricultural Research Account			3 265,80
TOTAL REVENUE			3 211 770,87

(b) REVENUE (SOUTH WEST AFRICA)

	R	R
1. Rentals from houses		24,00
2. Departmental receipts		
Vaccines	3 319,19	
Goods and services	256 508,13	
Publications	338,37	
3. Miscellaneous revenue	26 443,90	286 609,59
TOTAL REVENUE		286 633,59

(c) EXPENDITURE (REPUBLIC)

	Vote	Expenditure
	R	R
Salaries, etc.	25 089 000	25 136 019,48
Subsistence and Transport	3 658 800	4 055 615,90
Postal Services etc.	265 000	367 606,07
Printing	573 000	769 119,92
Miscellaneous	482 000	370 518,06
Plant Protection	88 000	86 634,14
Animal and Dairy Science	562 000	396 426,51
Tobacco	57 000	50 525,64
Soil	58 000	46 221,04
Horticulture	38 000	32 332,22
Citrus and Subtropical Fruit	118 000	90 947,15
Fruit and Fruit Technology	147 000	121 225,65
Botany	47 000	42 184,88
Oenology and Viticulture	69 000	59 264,78
Veterinary	797 000	787 109,35
Veterinary Field Services	1 386 000	1 345 914,98
Plant Pest Control	1 655 000	1 613 688,06
Agricultural Information	101 000	62 927,44
Agricultural Engineering	454 000	306 657,92
Seed Control	25 000	9 197,93
Regions	1 002 000	858 507,81
Soil Conservation	12 091 000	11 937 795,97
Agricultural Research Stations	649 000	584 787,42
Agricultural Scholarships etc.	440 200	433 777,02
Minor works	271 000	214 449,15
TOTAL	50 123 000	49 779 454,49

(d) EXPENDITURE (SOUTH WEST AFRICA)

	Vote	Expenditure
	R	R
Salaries and allowances	1 500 000,00	1 549 515,15
Subsistence and transport	763 000,00	800 123,99
Postal services, etc.	28 000,00	30 234,13
Printing, etc.	20 000,00	7 641,17
Miscellaneous	18 200,00	15 308,31
Agriculture	37 000,00	43 599,36
Veterinary	440 000,00	267 994,08
Soil conservation	1 612 800,00	1 365 996,97
Agricultural experiment farms	211 000,00	197 675,31
Minor works	20 000,00	20 007,91
TOTAL	4 650 000,00	4 298 096,38

(4) BUILDINGS

(a) Major constructions completed

Pretoria: Faculty of Agriculture	R251 000
Stellenbosch: Helderfontein — Diagnostic centre	R305 000

(b) Major constructions in hand

Pretoria: Brummeria — Herbarium	R805 344
Kemptonpark: Jan Smuts Airport — Quarantine Station	R863 000

(5) SCIENTIFIC PUBLICATIONS

Agricultural Chemistry

- BEYERS, C.P. DE L. & COETZER, F.J., 1971. Effect of concentration, pH and time on the properties of di-ammonium E.D.T.A. as a multiple soil extractant. *Agrochemophysica* 3, 49–53.
- BEYERS, C.P. DE L. & HAMMOND, T., 1971. The relationship between copper uptake by barley seedlings and various forms of extractable soil copper. *Agrochemophysica* 3, 23–26.
- BURGER, R. DU T., 1971. The soil as a factor in protein production. In J.W. Claassen & H.J. Potgieter (ed.) *Proteins and Food Supply in the Republic of South Africa*. Cape Town: A.A. Balkema.
- BURGER, R. DU T. & DU PLESSIS, S.F., 1971. Die effek van oormatige bespuitings met koper op die chemiese samestelling van sitrusblare. *S. Afr. Citrus J.*, 446.
- COETZER, J. & PIETERSE, M.J., 1972. A degradation product of a constituent of *Lasiosiphon burchellii*. *Jl S. Afr. chem. Inst.* 24, 241.
- DEIST, J., MARAIS, P.G., HARRY, R.B.A. & HEYNS, C.F.G., 1971. Relative availability of rock phosphate to different plant species. *Agrochemophysica* 3, 35–40.
- DEIST, J., MARAIS, P.G. & HEYNS, C.F.G., 1971. Effect of contact time of labelled fertilizer with soil on the estimation of labile phosphate. *Agrochemophysica* 3, 55–62.
- DELWICHE, C.C. & STEYN, C.C., 1970. Nitrogen isotope fractionation in soils and microbial reactions. *Envir. Sci. Technol.* 4, 929–935.
- DE VILLIERS, J.M., 1971. The problem of quantitative determination of allophane in soil. *Soil Sci.* 112, 2–7.
- DU PLESSIS, S.F., 1970. 'n Ondersoek na metodes vir die bepaling van die katione-uitruilkapasiteit van gronde en faktore wat 'n bydrae tot die katione-uitruilkapasiteit lewer. *Agrochemophysica* 2, 61–64.
- DU PLESSIS, S.F., 1971. Grondontleding om die fosforgehalte van sitrusbome te bepaal. *Citrus subtrop. Fruit J.* 454, 7–8.
- DU PLESSIS, S.F. & BURGER, R. DU T., 1971. Die effek van oormatige kopertoedienings op die groei van sitrussaailinge. *S. Afr. Citrus J.*, 446.
- DU PLESSIS, S.F. & BURGER, R. DU T., 1971. Spesifieke adsorpsie van koper deur 'n aantal gronde. *Misstofveren. S. Afr. J.* 1, 31–33.
- DU PLESSIS, S.F. & BURGER, R. DU T., 1971. Die effek van oormatige hoeveelhede koper in die grond op sitruswortels. *Misstofveren. S. Afr. J.*, 1, 35–37.
- DU PLESSIS, S.F. & BURGER, R. DU T., 1971. Die spesifieke adsorpsie van koper deur kleimineraal en grondfraksies. *Agrochemophysica* 3, 1–10.
- DU PLESSIS, S.F. & BURGER, R. DU T., 1971. The displaceability of specifically adsorbed copper from clay minerals. *Agrochemophysica* 3, 17–22.
- DU PLESSIS, S.F. & BURGER, R. DU T., 1971. Enkele faktore wat die oplosbaarheid van koper in 'n waterige medium beïnvloed. *Agrochemophysica* 3, 41–44.
- DU PLESSIS, S.F. & KOEN, T.J., 1970. Oplosbaarheid van verskillende rotsfosfate. 'n Laboratorium ondersoek. *Agrochemophysica* 2, 45–46.
- FITZPATRICK, R.W., TURNER, D.P., CASS, A. & SUMNER, M.E., 1971. Reclamation of some sodic soils by the high salt water dilution method. *Proc. S. Afr. Sug. Technol. Ass.* 45.
- HAASBROEK, F.J., DE VILLIERS, JOHANNA F., DEIST, J. & ROUSSEAU, P.C., 1971. Measurement of ^{32}P in wet-ashed plant samples utilizing Cerenkov radiation. *Agrochemophysica* 3, 27–32.
- HAHNE, H.C.H. & ORCHARD, E.R., 1970. Maize nutrition I. Nitrogen and phosphorus content of maize leaves in relation to fertilizer treatment and grain yield. *Agrochemophysica* 53–60.

- HAHNE, H.C.H. & ORCHARD, E.R., 1970. Maize nutrition II. Potassium calcium and magnesium content of maize leaves in relation to fertilizer treatment and grain yield. *Agrochemophysica* 2, 85–92.
- HENSLEY, M., 1970. Brak, a threat to our irrigation schemes. *S. Afr. J. Sci.* 66, 180–181.
- KOEN, T.J., DU PLESSIS, S.F. & LANGENEGGER, W., 1971. Blaaronltedings van Valencias: Seisoensvariasie *Citrus subtrop. Fruit J.* 452, 22–23.
- LE ROUX, J., 1972. Quantitative clay mineralogical analysis of highly weathered soils. *Proc. S. Afr. Sug. Technol. Ass.* 46.
- LE ROUX, J., 1972. Clay minerology of Natal oxisols. *Proc. int. Clay Min. Conf., Madrid, Spain.* Abstract p. 236–237.
- ROBERTS, B.R., 1971. The role of the animal in soil fertility. *J. Fertil. Soc. S. Afr.* 2, 17–22.
- SCHWARZ, R.E. & VAN VUUREN, S.P., 1970. Centrifugal extraction of phenolic markers for indexing citrus greening and avocado sunblotch diseases. *Phytophylactica* 2, 65–68.
- STANTON, D.A. & BURGER, R. DU T., 1970. Studies on zinc in selected Orange Free State soils: IV. Factors affecting the availability of zinc. *Agrochemophysica* 2, 33–40.
- STANTON, D.A. & BURGER, R. DU TOIT., 1970. Studies on zinc in selected Orange Free State soils: V. Mechanisms for the reaction of zinc with iron and aluminium oxides. *Agrochemophysica* 2, 65–76.
- VAN NIEKERK, D.M. & KOEPPEN, B.H., 1972. Synthesis of 2-O--L-Rhamnopyranosyl-D-galactose, a reported partial hydrolysis product of α -Solanine, and some taste eliciting flavonoid 2-O--L-Rhamnopyranosyl-D-galactopyranosides. *Experientia* 28, 123–124.
- VAN REEUWYK, L.P. & DE VILLIERS, J.M., 1970. A model system for allophane. *Agrochemophysica* 2, 77–82.
- VAN WYK, A.J., 1972. A new bufadienolide of *Moraea polystachya* Ker. and *M. graminicola* Oberm. *Jl S. Afr. chem. Inst.* 25, 82–84.
- VERSTER, E., 1972. Soil survey of Makwassie. *Tech. Commun.* no. 56, 60 pp., *Dep. agric. tech. Serv. Repub. S. Afr.*
- WEBER, H.W. & VAN ROOYEN, P.C., 1971. Herwinning van brakgronde. *Wet. Vordering* 4, 3.
- WEBER, H.W. & VAN ROOYEN, P.C., 1971. Polysaccharides in molasses meal as an ameliorant for saline – sodic soils compared to other reclamation agents. *Geoderma* 6, 233–253.
- BURGER, P.J. & GROENEWALD, J.A., 1971. Die meet van bestuursinsette in die landbou. II. 'n Suid-Afrikaanse begrip van landboukundige progressiwiteit. *Agrekon* 10, 26–28.
- CARSTENS, N.W., 1971. 'n Ekonomiese ontleding van boerdery in die noordelike vleisstreke van Suidwes-Afrika. *Ekonomiese Reeks* no. 76, 76 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- FERREIRA, W.A., 1972. Makro-ekonomiese struktuurveranderings in die Sentraal-Karoo: *Izen-verslag*, U.O.V.S.
- LYNCH, D.R. & GRAVEN, E.H., 1971. Investigation of the culinary quality and prices commanded by Natal, Transvaal and Orange Free State grown potatoes on the Pietermaritzburg market. *Agroplantae* 3, 37–43.
- VAN WYK, B.J., 1971. 'n Bedryfsontleding van boerderye in die Oos-Kaapse kuststreek met spesiale verwysing na pynappels, sigorei en vars melk. *Dep. Landb.-Ekon. en -Bemark., Repub. S. Afr. Ekonomiese Reeks* no. 77, 61 pp.

Agricultural Engineering

- BOSHOFF, B. v. D., KROFTA, Z & LEE, D.A., 1971. Plantertoetsverslag nr. 7101: John Deere 26 eenheidplanter, 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- BOSHOFF, B. v. D., KROFTA, Z & LEE, D.A., 1971. Plantertoetsverslag nr. 7102: John Deere 1240 planter (sleeptipe). 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- BOSHOFF, B. v. D., KROFTA, Z. & LEE, D.A., 1971. Plantertoetsverslag nr. 7103. L.M. 44 Planter (sleeptipe). 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- BOSHOFF, B. v. D., KROFTA, Z. & LEE, D.A., 1971. Plantertoetsverslag nr. 7104. Safim 370–eenheidplanter. 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- BOSHOFF, B. v. D., KROFTA, Z. & LEE, D.A., 1971. Plantertoetsverslag nr. 7105: Soilmaster-eeenhedplanter. 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- BOSHOFF, B. v. D., KROFTA, Z. & LEE, D.A., 1971. Plantertoetsverslag nr. 7106: S.A. Wondereenhedplanter Model C. 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- BOSHOFF, B. v. D., KROFTA, Z. & LEE, D.A., 1971. Plantertoetsverslag nr. 7107: S.A. Wondereenhedplanter Model D. 6 pp. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- DE BEER, A.G. & JOHNSON, W.H., 1971. High temperature discolouration of foliar materials. *Landb.-ing. S. Afr.* 5, 6–14.

Agricultural Economics

- BURGER, P.J., 1971. Die meet van bestuursinsette in die landbou. III. Die opstelling en evaluering van 'n skaal. *Agrekon* 10, 5–11.

- DE BEER, A.G., LANDSBERG, J.P.H., KRIEK, N.P.J. & O'REILLY, J.H.W., 1971. Meganiese oes van grondboontjies te Marble Hall. *Tegn. Meded.* nr. 101, 17 pp., *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- HUGO, F.J.C., 1972. Kunsmisstrooier toetsverslag nr. 7209: Bogballe kunsmisstrooier model Z225, 3 pp. *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- HUGO, F.J.C., 1972. Kunsmisstrooier toetsverslag nr. 7210: Wittekind model 65 kunsmisstrooier, 3 pp. *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- HUGO, F.J.C., 1972. Kunsmisstrooier toetsverslag nr. 7211: Vicon Vari merk II kunsmisstrooier, 3 pp. *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- HUGO, F.J.C., 1972. Kunsmisstrooier toetsverslag nr. 7212: John Deere model L.F. kunsmisstrooier 2 pp. *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- HUGO, F.J.C., 1972. Kunsmisstrooier toetsverslag nr. 7213: L.M. 3000 kunsmisstrooier. 2 pp. *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- HUGO, F.J.C., 1972. Kunsmisstrooier toetsverslag nr. 7214: Lely kunsmisstrooier model H.R. 3 pp. *Dep. Landb.-tegn. Dienste*, Repub. S. Afr.
- LOTZ, E. VAN DER S., 1971. Integrated circuit switch for use in isotope research. *Agrochemophysics* 3, 45–46.
- MURRAY, J.K., 1971. 'n Benadering tot die ontwerp van wynkelders. *Landb.-ing. S. Afr.* 5, 15–21.
- PEROLD, R.P., 1971. Die welgevalle drywende lisimeter. *Landb.-ing. S. Afr.* 5, 49–53.
- VEENSTRA, J., 1971. Die toets van landbouwerktoe. *Landb.-ing. S. Afr.* 5, 45–48.
- LAMPRECHT, M.P., 1971. Spasiëring en top van oonddroogtabak in verskillende verbouingsgebiede. *Agroplantae* 3, 63–68.
- LAMPRECHT, M.P. & SNYMAN, H.G., 1971. Spasiëring en top van oonddroogtabakplante op swart kleigrond van Wes-Transvaal. *Agroplantae* 3, 21–26.
- LYNCH, D.R. & GRAVEN, E.H., 1971. Effect of rate of fertilization and stage of harvest on yield and culinary quality of four potato cultivars. *Agroplantae* 3, 7–14.
- MALLET, J.B. & DE JAGER, J.M., 1971. Effect of a moisture stress day upon maize performance. *Agroplantae* 3, 15–19.
- MALLET, J.B. & DE JAGER, J.M., 1971. Identification of a day of moisture stress in maize at Cedara. *Agroplantae* 3, 45–49.
- NEL, P.C., 1971. Where do we go from here? Some Research results, and the future of weed research in South Africa. *Mod. Fmg.*, 7, 29–30.
- NEL, P.C., 1971. Onkruide en hul beheer met klem op chemiese beheer in Suid-Afrika. *Pub. Univ. Pretoria. Nuwe Reeks* nr. 58, 24 pp.
- ROBBERTSE, P.J., 1971. Aanpasbaarheid van mieliecultivars onder Suid-Afrikaanse verbouingstoestande. *Verrigt. 4e Kongr. S. Afr. genet. Veren.* 83–86.
- VON LA CHEVALLERIE, M., VAN BILJON, P., BOSHOFF, P.J. & VAN DER MERWE, H.J., 1971. Die invloed van droogte op die samestelling van mieliekuilvoer. *S. Afr. J. Anim. Sci.* 1, 17–21.

Animal Science

- BASSON, W.D., 1971. A note on contamination of oesophageal fistula samples with rumen ingesta. *S. Afr. J. Anim. Sci.* 1, 45–47.
- BASSON, W.D. & NEL, J.W., 1970. The effect of a volatile fatty acid supplement on the utilization of a lamb-growth ration. *Proc. S. Afr. Soc. Anim. Prod.* 9, 127–130.
- BREDON, R.M. & MEAKER, H.J., 1971. How to calculate total digestible nutrients and digestible crude protein of feeds. *Leaflet No. 54, Dept. Agric. Tech. Serv.* Repub. S. Afr.
- BREDON, R.M. & SHORT, A.M., 1971. Oesophageal fistulation of cattle for pasture utilization studies, post-fistulation care, use of animals and sampling procedures. Research note. *Agroanimalia* 3, 141–144.
- CAMPBELL, Q.P., 1972. Influence of weight of dam on weaning weight of Dorper lambs. *S. Afr. J. Anim. Sci.* 2, 25–26.
- CLOETE, J.G., 1971. Drought feeding of sheep. *S. Afr. J. Anim. Sci.* 1, 201–214.
- CLOETE, J.G. & ROSSOUW, J.W., 1970. Influence of pelleting and the roughage concentrate ratio of fattening rations for old Merino sheep. *Agroanimalia* 2, 165–171.

Agricultural Extension

- BURGER, P.J., 1971. Die meet van bestuursinsette in die landbou. III. Die opstelling en evaluering van 'n skaal. *Agrekon* 10, 5–11.
- BURGER, P.J., 1972. Agricultural extension in Southern Africa — a look into the future. *Rhodesia Sci. News* 6, 44–49.
- BURGER, P.J. & GROENEWALD, J.A., 1971. Die meet van bestuursinsette in die landbou. II. 'n Suid-Afrikaanse begrip van Landboukundige progressiwiteit. *Agrekon*, 10, 26–28.
- KEMPEN, P.D., 1971. Ontwikkelingsmoontlikhede van die landdrostdistrik Hershel, met besondere verwysing na die landbou. *Isen-verslag*, U.O.V.S.

Agronomy

- HAMMES, P.S., 1971. Tuber initiation in the potato (*Solanum tuberosum* L.) *Agroplantae* 3, 73–74.
- KAISER, H.W., LISHMAN, A.W. & HULME, S.A., 1971. Influence of plant population density on the nutritive value of maize silage. *Agroanimalia* 3, 13–15.

- COETZEE, C.G., 1970. Die benutting van formaldehid behandelde vismeel en grondbone-oliekoekmeel deur skape. *Agroanimalia* 2, 139-144.
- COETZEE, C.G., BOSHOF, P.J., VAN DER MERWE, H.J. & VON LA CHEVALLERIE, M., 1971. 'n Bepaling van die optimum slaggewig van vroeggespeende lammers. *S. Afr. J. Anim. Sci.* 1, 117-123.
- COETZEE, J.J., VAN DER MERWE, J.J. & JOUBERT, D.M., 1970. Kuilvoerproduksie en -benutting op die Springbokvlakte. I. Kunsmatige verryking van babalakuilvoer. *Tegn. Meded. Dep. Landb.-tegn. Dienste, S. Afr.* nr. 93.
- COETZEE, J.J., VAN DER MERWE, J.J. & JOUBERT, D.M., 1971. Kuilvoerproduksie en -benutting op die Springbokvlakte. 2. Graanverrykingspeile van babalakuilvoer. *Tegn. Meded. Dept. Landb.-tegn. Dienste* nr. 97.
- DU TOIT, J.E.J., NEL, J.A. & CRONJE, P.J., 1971. Melkproduksie van Merino-ooie op verskillende voedingspeile. *Agroanimalia* 3, 51-58.
- HEYNS, H., 1971. Die invloed van geslag op die samestelling van bloed van kalwers. *Acta Acad.* 4, 33-36.
- HEYNS, H., 1971. The effect of breed on the composition of blood. *J. agric. Sci., Camb.* 76, 563-565.
- HEYNS, H., 1971. The relationship between various blood constituents of young Afrikaner bulls. *J. agric. Sci., Camb.* 77, 337-338.
- HEYNS, H., 1971. The effect of age on the composition of blood of beef and dairy cattle. *S. Afr. J. Anim. Sci.* 1, 95-99.
- HOFMEYR, H.S., KROON, FREDERIKA E., VAN RENSBURG, W.J.J. & VAN DER MERWE, LEONORA, 1972. Beskrywing van tegnieke en chemiese analises van skaapliggame en foute daaraan verbonde. *S. Afr. Tydskr. Week.* 2, 45-50.
- HOFMEYR, H.S., OLIVIER, ILZE, KROON, FREDERIKA E. & VAN RENSBURG, W.J.J., 1971. Mededeling oor verwantskap tussen tritiumruimte en liggaamsamestelling by drie skaaprasse. *S. Afr. Tydskr. Week.* 1, 13-14.
- HOFMEYR, H.S., VORSTER, P.W. & DE LA REY, P.J., 1971. Beskrywing van 'n apparaat om gaswisseling oor kort periodes by lammers te bepaal. *S. Afr. Tydskr. Week.* 1, 135-137.
- HUNTER, G.L., 1971. Is there a lactation anoestrus in the sheep? *S. Afr. J. Anim. Sci.* 1, 55-57.
- HUNTER, G.L., BELONJE, P.C. & VAN NIEKERK, C.H., 1971. Synchronized mating and lambing in springbred Merino sheep: The use of progestogen-impregnated intravaginal sponges and teaser rams. *Agroanimalia* 3, 123-140.
- JOUBERT, D.M., 1971. A note on the comparative microanatomy of *M. longissimus dorsi* of the African elephant and domestic bull. *S. Afr. J. Anim. Sci.* 1, 133.
- JOUBERT, D.M., 1971. Pre and post-natal growth and development of skeletal muscle in relation to lean meat quantity and quality. *S. Afr. J. Anim. Sci.* 1, 183-188.
- JOUBERT, D.M., 1971. On body size and cell size in the musculature of large and small mammals. *Agroanimalia* 3, 113-114.
- JOUBERT, D.M. & BOSMAN, W.M., 1971. The Nooitgedacht Pony. *S. Afr. J. Sci.* 67, 366-373.
- KEMM, E.H., PIETERSE, P.J.S., GRIESSEL, M. & MAMMES, P.A., 1971. The evaluation and standardisation of pig rations under South African conditions. I. A chemical and biological evaluation of a standard growth ration. *S. Afr. J. Anim. Sci.* 1, 3-7.
- KEMM, E.H. & RAS, M.N., 1971. The use of dried molasses in porker rations. *S. Afr. J. Anim. Sci.* 1, 9-11.
- KLINGBIEL, J.F.G. & NAUDÉ, R.T., 1971. Die voorkoms van bleek, sagte en waterige (BSW) spiere in spekvarkkarkasse by twee spekfabbrieke in Suid-Afrika. *S. Afr. Tydskr. Week.* 1, 109-112.
- KROON, FREDERIKA E., VAN RENSBURG, W.J.J. & HOFMEYR, H.S., 1972. Seisoenale veranderinge in chemiese samestelling van volwasse blesbokramme (*Damaliscus dorcas phillipsi*) van die van Riebeeck Natuurreervaat. *S. Afr. Tydskr. Week.* 2, 41-44.
- LATEGAN, P.J., MELLET, P. & NEL, J.W., 1971. Invloed van verskillende proteïenbronne op die groeivermoë en woleienskappe van vroeggespeende Merinolammers. *Agroanimalia* 3, 17-22.
- MEAKER, H.J. & VAN NIEKERK, C.H., 1971. The effect of nutrition prior to mating on synchronized oestrus in the ewe. *Agroanimalia* 3, 95-96.
- MEAKER, H.J. & VAN NIEKERK, C.H., 1971. The effect on fertility of flushing ewes for 1, 2, 3 or 4 weeks prior to synchronized matings. *Agroanimalia* 3, 107-110.
- MELLET, P. & LATEGAN, P.J., 1970. Research note: The determination of ammonia nitrogen in rumen fluids. *Agroanimalia* 2, 205.
- NAUDÉ, R.T., 1972. Die bepaling van spier, vet en been in karkasse en snitte van jong osse. *S. Afr. Tydskr. Week.* 2, 35-39.
- NAUDÉ, R.T., 1972. Die bepaling van spier, vet en been in karkasse en snitte van jong osse. *S. Afr. Tydskr. Week.* 2, 47-56.
- NAUDÉ, R.T., 1972. Bleek, sagte en waterige (BSW) varkvlies. *Jl S. Afr. vet. med. Ass.* 43, 47-56.
- NEL, J.A., 1971. Some aspects of breeding research on the Karakul in Southern Africa. *Proc. 2nd Intern. Karakul Congr. Piatra, Neaut, Rumania.*
- NEL, J.E., 1970. Subjekiewe beoordeling en die afleiding van teelwaarde by Merinoskape. *Agroanimalia* 2, 145-150.
- NEL, J.E., 1971. Inleiding tot bespreking oor die opknapping van teelpraktieke. *S. Afr. Tydskr. Week.* 1, 198-199.

- OLVER, M.D., 1971. Artificial insemination and duration of fertility in Chinese geese. *Agroanimalia* 3, 79.
- OSBOURN, D.E. & BREDON, R.M., 1971. The techniques of using oesophageal fistulated cattle for the study of pasture utilization. *Jl S. Afr. vet. med. Ass.* 42, 51–55.
- OSTERHOFF, D.R., 1971. Belangrike genetiese en statistiese vakterme in veeteelt. Publikasie. *Dep. Landb.-tegn. Dienste, Repub. S. Afr.*
- OSTERHOFF, D.R., OP'THOF, J. & COUBROUGH, R. I., 1972. Biochemical polymorphisms and the aborting Angora goat. *Proc. VII th Int. Congr. Anim. Reprod. & A.I. Munich.*
- OSTERHOFF, D.R. & WARD-COX, I.S., 1972. Blood polymorphic systems and stress in cattle. *Proc. XII th Eur. Conf. Anim. Bl. Gr. & Biochem. Polymorph.* Budapest, 1970, 211.
- OSTERHOFF, D.R. & WARD-COX, I.S., 1972. Quantitative studies on horse haemoglobins. *Proc. XII th Eur. Conf. Anim. Bl. Gr. & Biochem. Polymorph.* Budapest, 1970, 541.
- OSTERHOFF, D.R. & WARD-COX, I.S., 1972. Serum polymorphism in three South African goat breeds. *Proc. XII th Eur. Conf. Anim. Bl. Gr. & Biochem. Polymorph.* Budapest, 1970, 579.
- OSTERHOFF, D.R., WARD-COX, I.S. & PIETERSE, G., 1971. Preliminary results on electrophoretic and immunoelectrophoretic fractionation of bovine muscle extract. *S. Afr. J. Anim. Sci.* 1, 103.
- OSTERHOFF, D.R., YOUNG, E. & WARD-COX, I.S., 1972. Natural variation of the blood protein types of the African elephant (*Loxodonta africana*). *Proc. XII th Eur. Conf. Anim. Bl. Gr. & Biochem. Polymorph.* Budapest, 1970, 683.
- PRETORIUS, P.S., 1970. Effect of aggressive behaviour on production and reproduction in the Angora goat (*Capra hircus angoraensis*). *Agroanimalia* 2, 161–164.
- PRETORIUS, P.S., 1971. Gross ovarian changes in the cycling and anoestrous Angora goat does. *S. Afr. J. Anim. Sci.* 1, 63–66.
- PRETORIUS, P.S. & VAN DER WESTHUYSEN, J.M., 1971. Induction of breeding activity in anoestrous Angora goat does. *Agroanimalia* 3, 27–29.
- REYNEKE, J., 1971. Wintering systems for cows in the eastern Highveld. *S. Afr. J. Anim. Sci.* 1, 39–42.
- REYNEKE, J., 1971. Suitable feeding systems for fat lamb production. *S. Afr. J. Anim. Sci.* 1, 49–53.
- ROSSOUW, A.F., SKINNER, J.D. & KEMM, E.H., 1971. The effect of androstenedione on growth, carcass composition and reproductive development of porkers. *S. Afr. J. Anim. Sci.* 1, 85–89.
- ROUX, P.W. & DE KOCK, G.C., 1971. Benutting van *Kochia brevifolia* deur skape. *Hand. Weidingsveren. S. Afr.* 6, 108–117.
- SKINNER, J.D., 1971. Report on the sexual cycle in the kudu bull *Tragelaphus strepsicero pallas* and a description of an inter-sex. *Zoologica Afr.* 6, 293–299.
- SKINNER, J.D., 1971. A bilateral cryptorchid springbok ram *Antidorcas marsupialis marsupialis*. *J. Reprod. Fert.* 26, 377–378.
- SKINNER, J.D., 1972. Productivity of the eland: An appraisal of the last five years research. *S. Afr. J. Sci.* 67, 534–539.
- SKINNER, J.D. & HUNTLEY, B.J., 1971. The sexual cycle in the blesbok ram *Damaliscus dorcas phillipsi*. *Agroanimalia* 3, 23–26.
- SKINNER, J.D., JÖCHLE, W. & NEL, J.W., 1970. Research note: Induction of parturition in Karakul and crossbred ewes with flumethasone. *Agroanimalia* 2, 99–100.
- SKINNER, J.D. & VAN HEERDEN, J.A.H., 1971. The effect of daylength on the reproductive tract of the Merino ram. *S. Afr. J. Anim. Sci.* 1, 77–80.
- SKINNER, J.D., VAN HEERDEN, J.A.H. & VAN ZYL, J.H.M., 1971. A preliminary note on the effect of season on the reproductive tract of the eland bull. *S. Afr. J. Anim. Sci.* 1, 81–84.
- SKINNER, J.D., VAN RENSBERG, S.J. & BADENHORST, J.F.G., 1971. The occurrence of foetal dwarfism in the Angora goat. *S. Afr. J. Anim. Sci.* 1, 69–72.
- SKINNER, J.D. & VAN ZYL, J.H.M., 1971. The post-natal development of the reproductive tract of the springbok ram lamb *Antidorcas marsupialis marsupialis* Zimmerman. *Zoologica Afr.* 6, 301–311.
- SKINNER, J.D., VON LA CHEVALLERIE, M. & VAN ZYL, J.H.M., 1971. An appraisal of the springbok for diversifying animal production in Africa. *Anim. Breed. Abstr.* 39, 215–224.
- STEENKAMP, C.H., VENTER, J.J. & EDWARDS, W.K., 1970. Seasonal effect on weathering of wool. *Agroanimalia* 2, 127–130.
- SWART, J.A. & NIEMANN, P.J., 1971. The nutritive value index as an indicator of the economic value of roughages. *S. Afr. J. Anim. Sci.* 1, 15.
- SWART, J.A., NIEMANN, P.J., ENGELS, E.A.N. & BIEL, L.C., 1971. The influence of fish meal and yellow maize on the nutritive value of *Themeda triandra* for Merino sheep. *S. Afr. J. Anim. Sci.* 1, 25.
- TERBLANCHE, I.L., MULDER, A.M. & ROSSOUW, J.W., 1971. Die invloed van voginhoud op die droë materiaalinnome en verteerbaarheid van doringlose turksvyblaaie. *Agroanimalia* 3, 73–77.
- VAN DER WESTHUYSEN, J.M., 1971. Effect of dietary energy and protein levels on early embryonic mortality in young and mature Merino ewes. *Agroanimalia* 3, 91–94.
- VAN DER WESTHUYSEN, J.M., 1971. A note on the effects of maternal or foetal injection of flumethasone and of thyroidectomy on the termination of pregnancy. *S. Afr. J. Anim. Sci.* 1, 67.

- VAN DER WESTHUYSEN, J.M., 1971. Observations on the effects of season and age of ewe, on the mating behaviour of Merino rams. *Agroanimalia* 3, 111–112.
- VAN DER WESTHUYSEN, J.M., 1972. The insulin tolerance test and the outcome of pregnancy in normal and habitual aborter Angora goat does. *S. Afr. J. Anim. Sci.* 2, 23.
- VAN DER WESTHUYSEN, J.M. & ROELOFSE, C.S.M.B., 1971. The effect of shelter and different levels of dietary energy and protein on the reproductive performance in Angora goats with special reference to the habitual aborter. *Agroanimalia* 3, 129–132.
- VAN DER WESTHUYSEN, J.M. & VAN NIEKERK, C.H., 1971. Synchronization of oestrus in sheep early in the breeding season. The vaginal environment and fertility. *S. Afr. J. Anim. Sci.* 1, 59–62.
- VAN DER WESTHUYSEN, J.M., VAN NIEKERK, C.H. & HUNTER, G.L., 1970. Duration of oestrus and time of ovulation in sheep: Effect of synchronization, season and ram. *Agroanimalia* 2, 131–138.
- VAN DER WESTHUYSEN, J.M. & WENTZEL, D., 1971. Progress through selection against the aborting Angora goat. *S. Afr. J. Anim. Sci.* 1, 101–102.
- VAN NIEKERK, C.H., 1971. 'n Oorsig van die metodes vir die bepaling van die geslagshormone. *S. Afr. Tydskr. Veek.* 1, 225–230.
- VAN WYK, C.M. & VENTER, J.J., 1971. The effect of uniplanar crimps on the bending behaviour of fibres and filaments. *J. Text. Inst.* 62, 655–676.
- VAN WYK, G.N., VAN DER MERWE, G.D., DREOSTI, G.M., VAN DER MERWE, R.P. & ATKINSON, A., 1971. The effect of stabilized fish meal on the flavour of pork. *Agroanimalia* 3, 65–72.
- VISSER, D., LE ROUX, P.J. & AGENBAG, G.J., 1971. 'n Ondersoek na paarselsels by Karakoelskape op die Kalahari proefstasie, Suidwes-Afrika. *Agroanimalia* 3, 87–90.
- VON LA CHEVALLERIE, M., 1971. Meat production from the dairy herd. *Meat Ind., Pretoria* 20, 29–36.
- VON LA CHEVALLERIE, M., ERASMUS, J., SKINNER, J.D. & VAN ZYL, J.H.M., 1971. A note on the carcass composition of the common eland (*Taurotragus oryx*). *S. Afr. J. Anim. Sci.* 1, 129–131.
- VON LA CHEVALLERIE, M. & VAN SCHALKWYK, A.P., 1971. Proteïënaanvulling vir jong vleisbeeste op mieliekuilvoer ingekuul met of sonder ureum. *S. Afr. J. Anim. Sci.* 1, 23–24.
- VON LA CHEVALLERIE, M. & VAN ZYL, J.H.M., 1971. Growth and carcass development of the springbok *Antidorcas marsupialis marsupialis* (Zimmerman). *Agroanimalia* 3, 115–124.
- VON LA CHEVALLERIE, M. & VAN ZYL, J.H.M., 1971. Some effects of shooting on losses of meat and meat quality in springbok and impala. *S. Afr. J. Anim. Sci.* 1, 113–116.

Biochemistry

- DENNISON, C., 1971. L-2,4-Diaminobutyric acid as a standard in the estimation of lysine in maize samples. *J. Chromat.* 63, 409–410.
- DENNISON, C., STEAD, R.H. & QUICKE, G.V., 1971. A non-haemagglutinating toxic factor from the jack bean (*Canavalia ensiformis*). *Agroplantae* 3, 27–29.
- DREOSTI, I.E., GREY, P.C. & WILKINS, P.J., 1971. Deoxyribonucleic acid synthesis, protein synthesis and teratogenesis in zinc-deficient rats. *S. Afr. Nutr. Soc., Biennial Congress.* Durban, Sept., Abstracts p. 26.
- ENGELS, E.A.N., VAN SCHALKWYK, A., MALAN, A. & BAARD, MARGARIETHA A., 1971. The chemical composition and *in vitro* digestibility of forage samples selected by oesophageal fistulated sheep on natural pasture of the central Orange Free State. *S. Afr. J. Anim. Sci.* 1, 43–44.
- ENGELS, E.A.N., VAN SCHALKWYK, A., NIEMANN, P.J. & SWART, J.A., 1970. The effect of source of inoculum on *in vitro* digestibility of forages. *Agroanimalia* 2, 117, 120.
- ENGELS, E.A.N., VAN SCHALKWYK, A., NIEMANN, P.J. & SWART, J.A., 1970. *In vitro* digestibility of forages as an indication of nutritive value. *Agroanimalia* 2, 181–184.
- NAUDE, T.W. & POTGIETER, D.J.J., 1971. Studies on South African cardiac glycosides. I. Isolation of toxic principles of *Homeria glauca* (W. & E.) N.E. Br. and observations on their chemical and pharmacological properties. *Onderstepoort J. vet. Res.* 38, 255–278.
- VAN RENSBURG, P.J. & COETZEE, W.H.K., 1971. 'n Metode vir die *in vitro* bepaling van proteïensintese deur rumen-mikro-organismes vanaf nie-proteïenstikstof. *Agroanimalia* 3, 47–48.
- WILKINS, P.J. & DREOSTI, I.E., 1970. Plasma zinc levels in zinc-deficient rats. *Agrochemophysica* 2, 84–85.
- WILKINS, P.J., GREY, P.C. & DREOSTI, I.E., 1972. Plasma zinc as an indicator of zinc status in rats. *Br. J. Nutr.* 27, 113–120.

Botany

- BORNMAN, C.H. & ELLIS, R.P., 1971. Aspects of cellular growth and development in *Nicotiana tabacum* tissue cultured *in vitro* JI S. Afr. Bot. 37, 269–280.
- CODD, L.E., 1971. Generic limits in *Plectranthus*, *Coleus* and allied genera. *Mitt. bot. StSamml. Münch.* 10, 245–252.

- COERTZE, A.F., SCHWEICKERDT, H.G. & VAN DER SCHÛFF, H.P., 1971. Voortplanting by *Podocarpus henkelii* Stapf ex Dallim. & Jacks: I. Die keëls, gametofiete en bevrugting. *S. Afr. Tydskr. Wet.* 67, 376–396.
- COERTZE, A.F., VAN DER SCHÛFF, H.P. & SCHWEICKERDT, H.G., 1971. Reproduction in *Podocarpus henkelii* Stapf ex Dallim. & Jacks: II Embryogeny. *S. Afr. J. Sci.* 67, 418–431.
- DE WINTER, B., 1971. Araceae. *Stand. Encycl. sth. Afr.* 4, 288–289.
- DE WINTER, B., 1971. Ebenaceae. *Stand. Encycl. sth. Afr.* 4, 191.
- DE WINTER, B., 1972. Rubiaceae. *Stand. Encycl. sth. Afr.* 5, 119–120.
- DE WINTER, B., 1971. Floristic relationships between the northern and southern arid areas in Africa. *Mitt. bot. StSamml. Münch.* 10, 424–437.
- DE WINTER, B., 1972. South African plants in horticulture. *Pk Adm., Lond.* 25, 27–33.
- DE WINTER, B. & VAHRMEYER, J., 1972. Die Nasionale boomlys. Pretoria: Van Schaik. 125 pp.
- DYER, R.A., 1971. *Brachystelma cathcartense*, sp. nov. *Bothalia* 10, 431–432.
- DYER, R.A., 1971. Euphorbiaceae. *Stand. Encycl. sth. Afr.* 4, 397–399.
- DYER, R.A., 1972. Geraniaceae. *Stand. Encycl. sth. Afr.* 5, 170.
- DYER, R.A., 1972. Herbaria. *Stand. Encycl. sth. Afr.* 5, 487–488.
- DYER, R.A., 1971. *Zysmalobium trauseldii*, sp. nov. *Bothalia* 10, 433–434.
- EDWARDS, D. & LEISTNER, O.A., 1972. A degree reference system for citing biological records in Southern Africa. *Mitt. bot. StSamml. Münch.* 10, 501–509.
- EDWARDS, D. & NEL, M.D.S., 1972. A reconnaissance survey of aquatic macrophytes in the upper Orange River Catchment. *Civil Engineer in South Africa* 85–88.
- GIESS, W., 1971. Eine vorläufige Vegetationskarte von Südwestafrika. *Dinteria* 4, 114 pp.
- GUNN, M.D., 1971. Moritz Kurt Dinter. *Stand. Encycl. sth. Afr.* 4, 41–42.
- GUNN, M.D., 1971. Ethyl Mary Doidge. *Stand. Encycl. sth. Afr.* 4, 57–58.
- HARDY, D.S., 1971. A glimpse at the plant life of the Malagasy Republic. I. *Cactus Succ. J. Am.* 43, 125.
- HARDY, D.S., 1971. A glimpse at the plant life of the Malagasy Republic. II. *Cactus Succ. J. Am.* 43, 239.
- HARDY, D.S., 1971. Notes on a new species of aloe from South West Africa, *Aloe erinacea* Hardy. *Cactus Succ. J. Am.* 43, 218.
- KILLICK, D.J.B., 1971. Essenhout. *Stand. Encycl. sth. Afr.* 4, 389–390.
- KILLICK, D.J.B., 1971. Figs (*Ficus* spp.) *Stand. Encycl. sth. Afr.* 4, 490.
- KILLICK, D.J.B., 1971. Fig family (Moraceae). *Stand. Encycl. sth. Afr.* 4, 490.
- KILLICK, D.J.B., 1971. Progress with the flora of Southern Africa. *Mitt. bot. StSamml. Münch.* 10, 76–78.
- KILLICK, D.J.B., 1971. Vegetation of South Africa. In M. Tyack (ed.), *South Africa, Land of Challenge*, 22–25.
- KILLICK, D.J.B., 1972. *Crataegus*. *Stand. Encycl. sth. Afr.* 5, 452.
- KILLICK, D.J.B. & EDWARDS, D., 1971. Compilation of an ecological bibliography for Southern Africa. *Mitt. bot. StSamml. Münch.* 10, 487–488.
- MAUVE, A.A., 1972. *Gladiolus* (Iridaceae). *Stand. Encycl. sth. Afr.* 5, 201–202.
- MAUVE, A.A., 1972. Passifloraceae. *Stand. Encycl. sth. Afr.* 5, 303–304.
- MOLL, E.J., 1971. Natal trees, No. 18. *Podocarpus latifolius*. *Natal wild Life* 12, 23–25.
- MOLL, E.J., 1971. Natal trees, No. 19. *Millettia sutherlandii*. *Natal wild Life* 12, 26–27.
- MOLL, E.J., 1972. Natal trees, No. 20. *Vepris carringtoniana*. *Natal wild Life* 13, 20–21.
- MOLL, E.J., 1972. Ingwavuma Gorge – a unique wilderness area. *Natal wild Life* 13, 2–6.
- MOLL, E.J., WARD, C.J., STEINKE, T.D. & COOPER, K.H., 1971. Our mangroves threatened. *Afr. wild Life* 25, 103–107.
- MOLL, E.J. & WOODS, D.B., 1971. The rate of forest tree growth and a forest ordination at Xumeni, Natal. *Bothalia* 10, 451–460.
- MORRIS, J.H. & LEISTNER, O.A., 1971. Index of localities for Southern Africa. *Mitt. bot. StSamml. Münch.* 10, 498–500.
- RIJKENBERG, F.H.J., 1971. Proposal to conserve the name *Dendrophoma* Saccardo 1880. *Taxon* 20, 648–649.
- ROSS, J.H., 1971. *Acacia brevispica* and *A. schweinfurthii*. *Bothalia* 10, 419–426.
- ROSS, J.H., 1971. A variant of *Acacia karroo* from Sekukuniland. *Bothalia* 10, 427–430.
- ROSS, J.H., 1971. A new combination in *Gnidia*. *Bothalia* 10, 435–436.
- ROSS, J.H. & MORRIS, J.W., 1971. Principal components analysis of *Acacia burkei* and *A. nigrescens* in Natal. *Bothalia* 10, 437–450.
- TAYLOR, H.C., 1972. *Hakea*. *Stand. Encycl. sth. Afr.* 5, 414–416.
- THOM, J.E., 1971. A new species of *Dovyalis*. *Bothalia* 10, 434–435.
- VAN DER MERWE, J.J.M., 1971. New combination in *Cyphostemma*. *Bothalia* 10, 436.
- VAN HOEPEN, E., 1972. Fumariaceae. *Stand. Encycl. sth. Afr.* 5, 97.
- WELMAN, W.G., 1972. *Euryops* spp. *Stand. Encycl. sth. Afr.* 5, 439–440.
- WERGER, M.J.A., KRUGER, F.J. & TAYLOR, H.C., 1972. Pflanzensoziologische studie der Fynbosvegetation am Kap der Guten Hoffnung. *Vegetatio* 24, 71–89.

- BESTER, B.H. & CLAASSENS, J.W., 1970. The effect of various factors on the spore germination and growth of *Clostridium butyricum* and *Clostridium tyrobutyricum*. I. Various carbohydrates and buffers, age and preheating of spores. *Phytophylactica* 2, 237–242.
- BESTER, B.H. & CLAASSENS, J.W., 1971. The effect of various factors on the spore germination and growth of *Clostridium butyricum* and *Clostridium tyrobutyricum*. II. Several anions. *Phytophylactica* 3, 7–14.
- BESTER, B.H. & CLAASSENS, J.W., 1971. The effect of various factors on the spore germination and growth of *Clostridium butyricum* and *Clostridium tyrobutyricum*. III. Some inorganic cations. *Phytophylactica* 3, 61–68.
- CLAASSENS, J.W., BESTER, B.H. & FOURIE, K.H., 1971. The availability and utilisation of protein from milk in the Republic of South Africa, p. 209–218. In J.W. Claassens & H.J. Potgieter, (ed.), *Proteins and Food Supply in the Republic of South Africa*. Cape Town: A.A. Balkema.
- DE VILLIERS, P.G., FOURIE, K.H. & DOWNES, T.E.H., 1972. The efficiency of the infra-red pasteurisation of milk. *S. Afr. J. Dairy Technol.* 4, 121–124.
- DOWNES, T.E.H., 1972. The influence of ripening conditions and surface treatments on the shrinkage, appearance and wax adhesion in Gouda cheese. *S. Afr. J. Dairy Technol.* 4, 101–105.
- DOWNES, T.E.H. & JAARSMA, J., 1972. Surface cracks in Gouda cheese. *S. Afr. J. Dairy Technol.* 4, 83–85.
- FOURIE, K.H., HERMANN, M.N. & BESTER, B.H., 1972. Bacillus species in Suid-Afrikaanse rou- en gepasteuriserende melk. *S. Afr. J. Dairy Technol.* 4, 127–133.
- HATHORN, F.A.S., 1971. Detergents and Sanitizers. *Proc. Inst. Publ. Health*, Univ. of Natal.
- HATHORN, F.A.S., 1971. Milking machines. *Proc. Inst. Publ. Health*, Univ. of Natal.
- HEYNS, H., 1971. The variation of blood constituents with stage of lactation in beef and dairy cattle. *S. Afr. J. Anim. Sci.* 1, 91–93.
- HEYNS, H., 1971. The nitrogen distribution in milk of beef and dairy cows. *S. Afr. J. Dairy Technol.* 3, 179–181.
- HOLZAPFEL, W.H., 1971. Die vriesdroging van suurselkulture. I. Faktore wat die aktiwiteite van gevriesdroogde reinkulture van *R. bulgaricus* en *S. thermophilus* beïnvloed. *S. Afr. J. Dairy Technol.* 3, 183–192.
- HOLZAPFEL, W.H. & MOSTERT, J.F., 1972. A microbiological study of South African Gouda cheese. *S. Afr. J. Dairy Technol.* 4, 82.
- JOOSTE, P.J. & GROENEVELD, H.T., 1971. Bacterial counts and dye reduction tests in relation to the keeping quality of South African pasteurized milk. *S. Afr. J. Dairy Technol.* 3, 193–201.
- LABUSCHAGNE, J.H., JOOSTE, P.J. & NOVELLO, J.C., 1971. The rate of temperature increase during the delivery of milk to the consumer. *S. Afr. J. Dairy Technol.* 3, 95–99.
- LÜCK, H., 1971. Die vriesdroging van suurselkulture. I. Faktore wat die aktiwiteit van gevriesdroogde reinkulture van *Lactobacillus bulgaricus* en *Streptococcus thermophilus* beïnvloed. *S. Afr. J. Dairy Technol.* 3, 183–192.
- LÜCK, H., 1972. Bacterial quality tests for bulk-cooled milk. *Dairy Sci. Abstr.* 34, 101–122.
- LÜCK, H., 1972. New aspects of sampling milk for butterfat determination. *S. Afr. J. Dairy Technol.* 4, 37–41.
- LÜCK, H., CLARK, P.C. & GROENEVELD, H.T., 1970. The suitability of dye reduction tests for estimating the bacterial quality of bulk-cooled milk. *Agroanimalia* 2, 69–76.
- LÜCK, H., DUNKELD, MARION & BECKER, P.J., 1972. The value of the nitrate reduction time for estimating the bacterial content of bulk-cooled and can-cooled milk. *S. Afr. J. Dairy Technol.* 4, 93–99.
- LÜCK, H. & GROENEVELD, H.T., 1972. The suitability of the milko-tester (FPM Combi-automatic) for determining the fat and protein content of milk. *S. Afr. J. Dairy Technol.* 107–112.
- LÜCK, H. & GROENEVELD, H.T., 1972. The applicability of the milko-tester mark III for determining the fat content of 10 day preserved composite samples. *S. Afr. J. Dairy Technol.* 4, 135–138.
- LÜCK, H. & HOLZAPFEL, W.H., 1971. Number of pseudomonads in refrigerated raw milk. *S. Afr. J. Dairy Technol.* 3, 112.
- LÜCK, H., HOLZAPFEL, W.H. & BECKER, P.J., 1971. Oxidasepositive colony count and its relationship to the psychrotrophic count of bulk-cooled milk. *Milchwissenschaft* 26, 424–427.
- LÜCK, H., HOLZAPFEL, W.H. & BECKER, P.J., 1971. Bacterial counts of bulk-cooled milk at different planting temperatures. *S. Afr. J. Dairy Technol.* 3, 139–143.
- LÜCK, H., LANGNER, E.H., GROENEVELD, H.T. & KNYE, P.H., 1970. The suitability and accuracy of the milko-tester for determining the fat content of preserved composite samples. *Agrochemophysica* 2, 1–6.
- LÜCK, H. & MOSTERT, J.F., 1971. Pasteurisation of fermented milk products. *S. Afr. J. Dairy Technol.* 3, 75–80.
- LÜCK, H. & MÜLLER-MULOT, W., 1971. The α -tocopherol (Vitamin E) content of South African butter. *S. Afr. J. Dairy Technol.* 3, 153–154.

- NOVELLO, J.C. & LABUSCHAGNE, J.H., 1971. Die koperinhoud en serum-pH van Suid-Afrikaanse botter. *S. Afr. Tydskr. Suiweltegnol.* 3, 147–150.
- SMITH, A. & ODENDAAL, P.J.D., 1971. Kontaminasie van spene met melk uit ander kwarte gedurende masjienmelking. *S. Afr. Tydskr. Suiweltegnol.* 3, 83.
- VAANDRAGER, G., 1972. Die aansuur vir pekel in Goudakaas. *S. Afr. J. Dairy Technol.* 4, 73–75.

Entomology

- ANNECKE, D.P. & INSLEY, H. PATRICIA, 1971. Notes on *Metaphycus ferrierei* Compare, 1940, with a description of the male. *J. ent. Soc. sth. Afr.* 34, 335–337.
- ANNECKE, D.P. & INSLEY, H. PATRICIA, 1972. The species of *Marietta* and a new *Centredora* from South Africa. *J. ent. Soc. sth. Afr.* 35, 1–15.
- ANNECKE, D.P. & MYNHARDT, M. JUDITH, 1971. The species of the *Zebratus*-group of *Metaphycus* Mercet (Hymenoptera: Encyrtidae) from South Africa with notes on some extralimital species. *Revue Zool. Bot. afr.* 83, 322–360.
- BOT, J. & HOLLINGS, N., 1971. A guide to the use of insecticides and fungicides in South Africa. *Dep. agric. tech. Serv., Repub. S. Afr.* 200 pp.
- BROODRYK, S.W., 1971. The biology of *Diadegma stellenboschense* (Cameron) (Hymenoptera: Ichneumonidae), a parasitoid of potato tuber moth. *J. ent. Soc. sth. Afr.* 34, 413–423.
- BROODRYK, S.W., 1971. Ecological investigations on the potato tuber moth *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae). *Phytophylactica* 3, 73–84.
- BROWN, H.D., 1971. Distribution and importance of the wheat aphid, *Schizaphis graminum* (Rond.) in South Africa. *J. ent. Soc. sth. Afr.* 34, 425–429.
- CAPENER, A.L., 1972. Angolan Membracidae (Hemiptera; Homoptera). *Separata* No. 84 *Publcoes. cult. Co. Diam. Angola*, Lisboa, 37: 46.
- CAPENER, A.L., 1972. New genera and species of African Membracidae (Hemiptera: Homoptera). *Entomology. Mem. Dep. agric. tech. Serv. Repub. S. Afr.*, No. 24, 52 pp.
- CILLIERS, CATHARINA J., 1971. Observations on circular purple scale *Chrysomphalus aonidum* (Linn.) and two introduced parasites in Western Transvaal citrus orchards *Entomophaga*, 16, 269–284.
- COATON, W.G.H., 1971. Five new termite genera from South West Africa (Isoptera: Termitidae). *Cimbebasia Ser. A*, 2(1), 34 pp.
- COATON, W.G.H., 1971. Isoptera, 90–95. In animal life in Southern Africa (eds. D.J. Potgieter, P.C. du Plessis & S.H. Skaife), *Cape Town: Nasou Lt.*, 469 pp.
- COATON, W.G.H. & SHEASBY, J.L., 1971. Soil poisons for proofing buildings against subterranean wood-destroying termites. *Phytophylactica* 3, 51–60.
- COATON, W.G.H. & SHEASBY, J.L., 1972. Preliminary report on a survey of the termites (Isoptera) of South West Africa. *Cimbebasia Mem.* 2, 129 pp.
- DAIBER, C.C., 1970. The influence of the host plant on the biology of cabbage aphids. *Phytophylactica* 2, 69–70.
- DAIBER, C.C., 1970. Cabbage aphids in South Africa: the influence of temperature on their biology. *Phytophylactica* 2, 149–156.
- DAIBER, C.C., 1971. Der Massenwechsel der Kohlläuse in Süd Afrika. *Z. Pflkrankh.* 78, 586–594.
- DAIBER, C.C., 1971. Cabbage aphids in South Africa: their field pupulations during the year. *Phytophylactica* 3, 15–28.
- DE LOTTO, G., 1971. A preliminary note on the black scales (Homoptera: Coccidae) of North and Central America. *Bull. ent. Res.*, 61, 325–326.
- DE LOTTO, G., 1971. On the status of two genera of soft scales (Homoptera: Coccoidea: Coccidae). *Bull. Lab. Ent. agr. Filippo Silvestri* 28 (1970), 257–261.
- DE LOTTO, G., 1971. The authorship of the Mediterranean black scale (Homoptera: Coccidae), *J. ent. (B)* 40, 149–150.
- DE LOTTO, G., 1971. Four new genera of Pseudococcidae (Homoptera: Coccoidea). *Bull. Lab. Ent. agr. Filippo Silvestri* 28 (1970), 245–256.
- DONALDSON, JEAN, M.I., 1971. Attempts to hatch cysts of *Malameba locustae* (King & Taylor) or control them with drugs. *Phytophylactica* 3, 103–106.
- DÜRR, H.J.R., 1971. The male of *Neophyllaphis grobleri* Eastop. (Hemiptera: Aphididae). *Phytophylactica* 3, 91–92.
- GEERTSEMA, H., 1971. The Southern African subspecies of *Nudaurelia cytherea* (Fabricius, 1775) (Lepidoptera: Saturniidae). *Ann. Transv. Mus.* 27, 171–181.
- GIESS, W., 1972. Vegetation types. In Coaton, W.G.H. & Sheasby, J.L. Preliminary report on a survey of the termites (Isoptera) of South West Africa. *Cimbebasia* 2, 13–17.
- HEWITT, P.H., NEL, J.J.C. & SCHOEMAN, INA, 1971. Influence of group size on water imbibition by *Hodotermes mossambicus* alate termites. *J. Insect Physiol.* 17, 587–600.
- HEWITT, P.H., WATSON, J.A.L. & NEL, J.J.C., 1972. Control of the change from group to pair behaviour by *Hodotermes mossambicus* reproductives. *J. Insect Physiol.* 18, 143–150.

- KEETCH, D.P., 1972. Ecology of citrus red mite *Panonychus citri* Mc Gregor (Acarina: Tetranychidae) in South Africa. 3. The influence of the predacious mite *Amblyseius* (*Typhlodromalus*) *addoensis* van der Merwe & Ryke. *J. ent. Soc. sth. Afr.* 35, 69–79.
- KLEYNHANS, K.P.N., 1969. Descriptions of *Hoplopleura aethomydis* n. sp. and of the male of *Polyplax solivago* (Anoplura: Hoplopleuridae). *Onderstepoort J. vet. Res.* 36, 299–302.
- NEVILL, E.M., 1971. Cattle and *Culicoides* biting midges as possible overwintering hosts of bluetongue virus. *Onderstepoort J. vet. Res.* 38, 65–72.
- RUELLE, J.E., 1971. New *Protermes* from Central Africa (Isoptera: Termitidae). *J. ent. Soc. sth. Afr.* 34, 369–379.
- SCHWARTZ, A., 1971. Verbetering op die tegniek van massateel van die valskodlingmot, *Cryptophlebia leucotreta* (Meyr.) *J. ent. Soc. sth. Afr.* 34, 431–433.
- SCHWARTZ, A., 1972. Valskodlingmotstudies. *Citrus Grow. Subtrop. Fruit J.* 461, 13.
- SCHWARTZ, A. & MILNE, D.L., 1972. Cold sterilisation and fumigation for control of false codling moth, *Cryptophlebia leucotreta* in export citrus fruit. *J. ent. Soc. sth. Afr.* 35, 129–137.
- THERON, J.G., 1971. Two new species of Cicadellidae (Hemiptera) from the Western Cape. *Novos Taxa ent.* 94, 1–6.
- THERON, J.G., 1971. Extended diapause in *Zonocryptus xanthomerus* Brullé (Hymenoptera: Ichneumonidae). *J. ent. Soc. sth. Afr.* 34, 187–188.
- VAN ARK, H. & PRETORIUS, LEONI M., 1970. The acute effect of dieldrin cover spraying on natural insect populations. *Phytophylactica* 2, 231–236.
- VAN ARK, H. & PRETORIUS, LEONI M., 1970. Subsampling of large light-trap catches of insects. *Phytophylactica* 3, 29–32.
- VAN DEN BERG, M.A., 1971a. Studies on the egg parasites of the mopane emperor moth *Nudaurelia belina* (Westw.) (Lepidoptera: Saturniidae). *Phytophylactica* 3, 33–36.
- VAN DEN BERG, M.A., 1971b. Studies on the induction and termination of diapause in *Mesocomys pulchriceps* Cam. (Hymenoptera: Eupelmidae) an egg parasite of Saturniidae (Lepidoptera). *Phytophylactica* 3, 85–88.
- VAN DEN BERG, H.C. & GILIOME, J.H., 1972. Aspects of the ecology and behaviour of *Eremnus cerealis* Marshall (Coleoptera: Curculionidae). I. The emergence and distribution of the larvae in the vineyard. *J. ent. Soc. sth. Afr.* 35, 171–176.
- WATSON, J.A.L., 1972. Ovarian activity during development of incipient colonies of the termite *Hodotermes mossambicus*. *J. Insect Physiol.* 18, 603–607.
- WATSON, J.A.L., HEWITT, P.H. & NEL, J.J.C., 1971. The watersacs of *Hodotermes mossambicus*. *J. Insect Physiol.* 17, 1705–1709.
- WATSON, J.A.L., NEL, J.J.C. & HEWITT, D.H., 1972. Behavioural changes in founding pairs of the termite, *Hodotermes mossambicus*. *J. Insect Physiol.* 18, 373–387.
- WIESE, I.H., BASSON, N.C.J. & VAN DER MERWE, J.H., 1970. Dynamics of dieldrin and its photoisomerization product, photodieldrin, on veld and livestock exposed to dieldrin treated veld. *Phytophylactica* 2, 33–48.

Genetics

- DU TOIT, A.F., & GEERTHSEN, J.M.P., 1971. Genetiese beheer van opbrengs in die mielievariëteit Pretoria Potchefstroom Pêrel. *Verrigt. 4e Kongr. S. Afr. Genet. Veren.* 78–82.
- DU TOIT, J.J., LOUW, J.H. & ALLAN, J.S., 1971. Seleksie vir liggaamsgewig by *Drosophila melanogaster*. *Acta Acad. (UOVS)* 4, 35–39.
- GEERTHSEN, J.M.P., 1971. The problem of genotype environment interaction in modern South African maize breeding. *Proc. 4th Congr. S. Afr. Soc. Genet.* 97.
- GEVERS, H.O., 1971. On the recovery of high lysine mutants opaque-2 and floury-2 in maize. *S. Afr. Genet. Soc.* (July 1970), Pretoria.
- GEVERS, H.O., 1972. Breeding for improved protein quality in maize. *Trans. R. Soc. S. Afr.* 40, 81–92.
- LAMPRECHT, M.P. & VAN WYK, R.J., 1971. Genetiese variasie by siekteweerstandbiedende Burleytabak. *Agroplantae* 3, 31–36.
- LIEBENBERG, H., 1971. Sitogenetiese studies ter oplossing van die taksonomiese probleme by *Themeda triandra*. *Verrigt. 4e Kongr. S. Afr. Genet. Veren.*, 28–30.
- MEYER, E.H.H., VAN SCHAIK, NANCY, OSTERHOFF, D.R. & GEERTHSEN, J.M.P., 1971. Preliminary studies on the serum of pigs. *Proc. 4th Congr. S. Afr. Soc. Genet.* 55–60.

Horticulture

- ALLAN, P., 1972. The future for macadamia nuts. I. *Citrus Grow. Subtrop. Fruit J.* 458, 9–12.
- BURGER, W.P., 1971. Die hervestigingsprobleem van sitrus. I. Oorsig van die basiese faktore. *Citrus Grow. Subtrop. Fruit J.* 17–20.
- DE LANGE, J.H., 1971. Bestuiwingsbehoefte van sitrus. *Citrus Grow. Subtrop. Fruit J.* 452, 12–13.
- DE LANGE, J.H. & VINCENT, A.P., 1971. Weefsel-verenigbaarheid van sitrus met enkele verwante inheemse Suid-Afrikaanse spesies. *Citrus Grow. Subtrop. Fruit J.* 451, 13–15.
- DE LANGE, J.H. & VINGENT, A.P., 1971. Cross-pollination of Navel Sweet Orange. *Citrus Grow. Subtrop. Fruit J.* 452, 15–16.

- DE LANGE, J.H. & VINCENT, A.P., 1971. Cross-pollination of the Washington Navel Orange. 2. Influence on fruit quality. *Agroplantae* 3, 1–4.
- DU PLESSIS, J.A. & HOLTZHAUSEN, L.C., 1972. Nuwe belowende praktyk vir sitruskwekerie. *Citrus Grow. Subtrop. Fruit J.* 461, 5–9.
- ESHUYS, W.A., OBERHOLZER, P.C.J., HOLTZHAUSEN, L.C. & VON STADEN, D.F.A., 1971. Nusellêre en ou-klone sitrusseleksies: 'n Vergelykende studie. *Citrus Grow. Subtrop. Fruit J.* No. 455, 13–23.
- EVANS, E.P., 1971. Three new peach cultivars. Orion, Albatros and Ingwe. *Agroplantae* 3, 51.
- EVANS, E.P., 1971. Two new table grape cultivars, Jakaranda and Golden City. *Agroplantae* 3, 53.
- GILFILLAN, I.M., HOLTZHAUSEN, L.C., KOEKEMOER, W. & DU PLESSIS, J.A., 1971. Picking season changes in Valencia quality factors. *Citrus Grow. Subtrop. Fruit J.* 454, 11–15.
- HAASBROEK, F.J. & ROUSSEAU, G.G., 1971. Effect of gamma-rays on cut *Protea compacta* R. Br. blooms. *Agroplantae* 3, 5–6.
- HURTER, N., 1971. Pollen tube development in pistils of the Marianna plum rootstock. *Proc. 4th Congr. S. Afr. Genet. Soc.*, July 1970, 19–21.
- HURTER, N., 1971. Embryo sac development in the Marianna plum rootstock. *Proc. 4th Congr. S. Afr. Genet. Soc.*, July, 1970, 22–27.
- KOEN, T.J., DU PLESSIS, S.F. & LANGENEGGER, W., 1971. Die verwantskap tussen blaarontledings, die grootte van die oes en die vrugkwaliteit van Valencias. *Citrus Grow. Subtrop. Fruit J.* 453, 26–28.
- MALAN, A.H. & CARSTENS, W.J., 1971. The cultivation of table grapes in South Africa. *Bull.* no. 388, 49 pp. *Dep. agric. tech. Serv. Repub. S. Afr.*
- STRYDOM, D.K., EKSTEEN, G.J., WALTERS, J.H. & DALTON, R., 1970. Growth and development of reproductive buds of certain deciduous fruit species during autumn, winter and spring. *Proc. 18th Hort. Congr.* 1, 81.
- WOLSTENHOLME, B.N., 1971. Development of the pecan nut – some implications for orchard management. *Citrus Grow. Subtrop. Fruit J.* 455, 7–10.
- JOUBERT, J.J. & RIJKENBERG, F.H.J., 1971. Studies on the host range of *Cephaleuros* spp. in Natal. *Rev. Biol.* 7, 197–202.
- LOOS, M.A., 1971. Metabolism of phenoxy herbicides by plants and soil micro-organisms. *Proc. Iupac. Int. Symp. on Pest, Term Res.* Tel. Aviv. Israel. London: Butterworths, pp. 291–304.
- RIJKENBERG, F.H.J. & MÜLLER, LORNA Y., 1971. An ultrastructural comparison between inter and intracellular mycelium and haustoria of rust fungi. *Proc. S. Afr. Electr. Micr. Soc.* pp. 25–26.
- RIJKENBERG, F.H.J., JOUBERT, J.J. & MILFORD, KATHLEEN T., 1971. The ultrastructure of the vegetative thallus of a plant parasitic-alga, *Cephaleuros virescens* Kunze. *Proc. S. Afr. Electr. Micr. Soc.* pp. 27–28.
- STAPHORST, J.L. & STRYDOM, B.W., 1971. Infectivity and effectiveness of colony isolates of ineffective glycine resistant *Rhizobium meliloti* strains. *Phytophyllactica* 3, 131–135.
- STEYN, P.L. & DELWICHE, C.C., 1970. Nitrogen fixation by nonsymbiotic micro-organisms in some California soils. *Envir. Sci. Technol.* 4, 1122–1128.
- VAN DEN HEEVER, L.W., 1972. The control of yeast on biltong with sorbic acid. *Fd Inds. S. Afr.* 25(1), 11–15.
- VAN RENSBURG, H. JANSEN & STRYDOM, B.W., 1969. Strains of *Rhizobium japonicum* and inoculant production in South Africa. *Phytophyllactica* 1, 201–204.
- VAN RENSBURG, H. JANSEN & STRYDOM, B.W., 1971. Stability of infectivity in strains of *Rhizobium japonicum*. *Phytophyllactica* 3, 125–130.
- VAN RENSBURG, H. JANSEN, STRYDOM, B.W. & RABIE, C.J., 1968. Nature of the genetic determinant of infectiveness in strains of *Rhizobium japonicum*. *S. Afr. J. Agric. Sci.* 11, 623–626.
- WEHNER, F.C. & RABIE, C.J., 1970. The micro-organisms in nuts and dried fruits. *Phytophyllactica* 2, 165–169.

Pasture Science

Microbiology

- BESTER, B.H., 1971. Bakteriespoortontkieming. *Tegnikon* 20, 9–14.
- ESCHENBRUCH, R., 1972. Für Substratabhängigkeit der H₂S – und SO₂-Bildung bei *Sacharomyces cerevisiae* Stämmen. *Wein-Wissenschaft* 27, 40–44.
- JOUBERT, J.J., 1971. Preliminary microbiological studies. Chapter 12, pp. 237–240 in *Marion and Prince Edward Islands. Eds. Van Zinderen Bakker, Winterbottom and Dyer*, Cape Town: Publ. Balkema.
- ACOCKS, J.P.H., 1971. The distribution of certain ecologically important grasses in South Africa.. *Mitt. bot. StSamml. Münch.* 10, 149–160.
- ANDERSON, J.G., 1972. Grass family. *Stand. Encycl. sth. Afr.* 5, 319–320.
- BOOYSEN, P. DE V., 1970. The pasture prospect in the humid grasslands of South Africa. *Proc. N.Z. Grassld Ass.* 32, 50–60.
- BOSCH, O.J.H. & VAN WYK, J.J.P., 1970. Die invloed van bosveldbome op die produktiwiteit van *Panicum maximum*: 'n Voorlopige verslag. *Hand. Weidingsveren. S. Afr.* 5, 69–74.

- COETSEE, G. & LE ROUX, D.P., 1971. Polygonal plot method for estimating the canopy-spread cover of shrubs. *Proc. Grassld Soc. sth. Afr.* 6, 176–180.
- DE JAGER, J.M., 1971. Model for expressing leaf photosynthesis in terms of weather variables. *Proc. Grassld Soc. sth. Afr.* 6, 144–151.
- DE JAGER, J.M., 1971. Simple model for crop photosynthesis in terms of weather variables and crop character. *Proc. Grassld Soc. sth. Afr.* 6, 152–156.
- DE JAGER, J.M., 1971. Theory for the assessment of environmental potential. *Agrochemophysica* 3, 67–70.
- DE KOCK, G.C. & LOTTER, B.A., 1970. Genotipe-omgewing wisselwerking in Suid-Afrikaanse lusern. *Verrigt. 4de kongr. S. Afr. Genet. Veren.* 116–119.
- GROBBELAAR, W.S., 1971. Regrowth of Cocksfoot, *Dactylis glomerata* (L) in response to repeated chipping under various conditions. *Proc. Grassld Soc. sth. Afr.* 6, 118–122.
- HILDYARD, P. & BOOYSEN, P. DE V., 1971. The influence of sward competition on shoot growth and development of *Senecio retrorsus* D.C. *Proc. Grassld Soc. sth. Afr.* 6, 39–43.
- JONES, R.I., 1971. A theoretical analysis of foraging efficiency of grazing animals. *Proc. Grassld Soc. sth. Afr.* 6, 161–169.
- JONES, R.I. & BARTHOLOMEW, P.E., 1971. A way to measure the spread of plants from a focus. *Proc. Grassld Soc. sth. Afr.* 6, 170–175.
- JONES, R.I. & CROSS, G.W., 1971. Effect of selective defoliation on species in mixed swards. *Proc. Grassld Soc. sth. Afr.* 6, 123–128.
- JOUBERT, J.G.V., 1971. 'n Voorlopige vergelyking tussen twee beweidingstelsels op Weskus Strandveld. *Hand. Weidingsveren. S. Afr.* 78–81.
- JOUBERT, J.G.V. & VAN BREDA, P.A.B., 1971. Bitou (*Osteospermum sinuatum*) besit die eienskappe om die veld van die Klein Karoo radikaal te verbeter. *Dept. Landb.-tegn. Dienste, Pretoria. Bladskrif nr. 56, Veldverbeteringsreeks nr. 1.*
- KIRKBY, D.W., 1971. Further investigation into the utilization of summer spared sourveld. *Proc. Grassld Soc. sth. Afr.* 6, 63–68.
- LOTTER, B.A. & DE KOCK, G.C., 1970. An analysis of the associations between yield and related variables in South African lucerne (*Medicago sativa*). *Proc. 4th congr. S. Afr. Genet. Soc.* 112–115.
- MALHERBE, C.E., 1971. Die resultate van sekere skaap tot beesverhoudingsproewe op suurveld uitgevoer. *Hand. Weidingsveren. S. Afr.* 6, 69–77.
- MOSTERT, J.W.C., ROBERTS, B.R., HESLINGA, C.F. & COETZEE, P.G.F., 1971. Veldmanagement in the Orange Free State Region. *Bull. Dep. agric. tech. Serv. Repub. S. Afr.* no. 391, 97 pp.
- OPPERMAN, D.P.J., ROBERTS, B.R. & VAN RENSBURG, W.L.J., 1969. The influence of defoliation on dry matter production and nutritive value of perennial veld grasses. *Agroplantae* 1, 133–137.
- OPPERMAN, D.P.J., ROBERTS, B.R. & VAN RENSBURG, W.L.J., 1970. Die invloed van ontblaring op die wortelgewigte, stoppelgewigte en reserwestatus van die meerjarige veldgrasse. *Agroplantae* 2, 51–59.
- RETHMAN, N.F.G., 1971. Elevation of shootapices of two ecotypes of *Themeda triandra* on the Transvaal Highveld. *Proc. Grassld Soc. sth. Afr.* 6, 86–92.
- RETHMAN, N.F.G., BEUKES, B.H. & MALHERBE, C.E., 1971. Influence on a North-eastern Sandy Highveld sward of winter utilization by sheep. *Proc. Grassld Soc. sth. Afr.* 6, 55–62.
- ROBERTS, B.R., 1971. Habitat preferences of twenty seven grasses. *Proc. Grassld Soc. sth. Afr.* 6, 44–49.
- SANDER, C.J., 1970. Opbrengsbepaling van veld met 'n elektroniese kapasiteitsinstrument. *Hand. Weidingsveren. S. Afr.* 5, 132–136.
- SCOTNEY, D.M., 1971. Land capability classification A basis for farm conservation planning. *Proc. Grassld Soc. sth. Afr.* 6, 101–107.
- SCOTNEY, D.M. & DE JAGER, J.M., 1971. The assessment of environmental potential. *Agrochemophysica* 3, 71–74.
- STEWART, F.C., CRAVEN, G.H., WEERASINGHE, S.P.R. & BIDWELL, R.G.S., 1971. Effects of prior environmental conditions on the subsequent uptake and release of carbon dioxide in the light. *Can. J. Bot.* 49, 1999–2007.
- SYMONS, L.B. & JONES, R.I., 1971. An analysis of available techniques for estimating production of pastures without clipping. *Proc. Grassld Soc. sth. Afr.* 6, 185–190.
- TAINTON, N.M., 1971. An analysis of the objectives of resting grassveld. *Proc. Grassld Soc. sth. Afr.* 6, 50–54.
- TROLLOPE, W.S.W. & BOOYSEN, P. DE V., 1971. The eradication of macchia (fynbos) vegetation on the Amatola mountains of the Eastern Cape. *Proc. Grassld Soc. sth. Afr.* 6, 28–38.
- VAN DER WALT, J.L., 1971. Voorlopige verslag oor die reaksie van Dorre Karooveld op beweiding gedurende spesifieke jaargetye: Boesmangrasveld. *Hand. Weidingsveren. S. Afr.* 6, 82–85.
- VAN GINKEL, B., 1971. Plantkundige en drakragveranderinge deur bemesting van 'n *Cymbopogon-Themeda*-veldtipe. *Dep. Landb. tegn. Dienste, Repub. S. Afr. Tegn. Meded. Nr. 98.*
- VAN RENSBURG, P.H.J.J., 1971. Grondbewerking en die saai van *Eragrostis curvula*-saad op erg vernielde *Themeda-Cymbopogon*-veld. *Hand. Weidingsveren. S. Afr.* 6, 93–100.

VAN WYK, J.J.P. & BOSCH, O.J.H., 1970. Grassland ecosystem: Reviews of research. Report of National project, Repub. S. Afr. Ed. by Coupland, R.P. & Van Dyne, G.M. *Proc. 2nd Meeting of the P.T. Grassland Working Group. Internal. Biol. Programme*, Canada.

Plant Pathology

- BRODRICK, H.T., 1971. Toxicity of limonene and citrus peel extracts to *Guignardia citricarpa* Kiely. *Phytophylactica* 3, 69–72.
- BRODRICK, H.T., 1971. Osmotic pressure changes in the orange peel in relation to symptom development of citrus black spot caused by *Guignardia citricarpa* Kiely. *Phytophylactica* 3, 89–90.
- BRODRICK, H.T., GILBERTSON, B. & KRETZER, M.H., 1971. Advances in aerial photography. Detecting avocado *Phytophthora* root rot. The use of multispectral photographic techniques. *S. Afr. Citrus J.* 449, 9–13.
- BRODRICK, H.T. & RABIE, C.J., 1970. Light and temperature effects on symptom development and sporulation of *Guignardia citricarpa* Kiely, on *Citrus sinensis* (Linn.) Osbeck. *Phytophylactica* 2, 157–163.
- DESCHODT, C.C., 1970. *Cephaleuros virescens* a potential danger for tea production in South Africa. *Phytophylactica* 2, 275–276.
- GORTER, G.J.M.A., 1971. Nuwe rigtings in die chemiese bestryding van plantsiektes (S.A. Akademie vir Wetenskap en Kuns). *Tydskr. Natuurwet.* 11, 85–92.
- GREEN, G.C. & CATLING, H.D., 1971. Weather-induced mortality of the citrus psylla, *Trioza erytrae* (Del Guercio) (Homoptera: Psyllidae), a vector of greening virus in some citrus producing areas of Southern Africa. *Agric. Met.* 8, 305–317.
- HATTINGH, M.J., 1972. A note on the fungus *Endogone*. *Jl. S. Afr. Bot.* 38, 29–31.
- JOUBERT, J.J. & RIJKENBERG, F.H.G., 1971. Parasitic green algae. *Ann. Rev. Phytopath.* 9, 45–64.
- KOTZE, J.M., 1971. Uitwerking van droogte op die ontwikkeling van swartvlek van sitrus. *Citrus Grow. Subtrop. Fruit J.* 452.
- MARASAS, W.F.O., 1971. Cotton staining caused by *Crebrothecium ashbyi* (*Eremothecium ashbyi*) in South Africa. *Bothalia* 10, 407–410.
- MARASAS, W.F.O., SMALLEY, E.B., BAMBURG, J.R. & STRONG, F.M., 1971. Phytotoxicity of T-2 toxin produced by *Fusarium tricinotum*. *Phytopathology* 61, 1488–1491.
- MARASAS, W.F.O. & VAN DER WESTHUIZEN, G.C.A., 1971. New and interesting records of South African Fungi, Part VII. *Bothalia* 10, 411–416.
- MCCLEAN, A.P.D., 1970. Greening disease of sweet orange: its transmission in propagative parts and distribution in partly diseased trees. *Phytophylactica* 2, 263–268.
- MCCLEAN, A.P.D. & SCHWARZ, R.E., 1970. Greening or blotchymottle disease of citrus. *Phytophylactica* 2, 177–194.
- MILNE, D.L. & CHAMBERLAIN, J., 1971. Experimental control of avocado *Phytophthora* root rot in South Africa. *S. Afr. Citrus J.* 449, 15–16.
- MILNE, D.L., DE VILLIERS, E.A. & HOLTZHAUSEN, L.C., 1971. Litchi tree decline caused by nematodes. *Phytophylactica* 3, 37–44.
- RIJKENBERG, F.H.J. & TRUTER, SUSARAH, J., 1971. *Dendrophoma obscurans* on strawberry. *Phytophylactica* 3, 147.
- SCHWARZ, R.E., 1971. The value of Orlando tangelo as an indicator for the graft transmissible gum-pocket disease of *Poncirus trifoliata*. *Phytophylactica* 3, 151–153.
- SCHWARZ, R.E., MCCLEAN, A.P.D. & CATLING, H.D., 1970. The spread of greening disease by citrus psylla in South Africa. *Phytophylactica* 2, 59–60.
- SCHWARZ, R.E. & VAN VUUREN, S.P., 1971. Decrease in fruit greening of sweet orange by trunk injection of tetracyclines. *Pl. Dis. Repr.* 55, 747–749.
- TRUTER, SUSARAH H. & MARTIN, M.M., 1971. Occurrence of spermogonia and aecia on *Antirrhinum majus*. *Phytophylactica* 3, 149.
- VAN WYK, P.S. & BAARD, S.W., 1970. *Verticillium dahliae* parasitic on *Fusarium* species. *Phytophylactica* 2, 212.
- VAN WYK, P.S. & BAARD, S.W., 1971. Germination of conidia of *Verticillium dahliae* in soil. *Pl. Soil* 35, 601–611.
- WAGER, VINCENT A., 1972. Records of diseases of ornamental plants not previously reported in South Africa. Dep. Agric. tech. Serv., Repub. S. Afr., *Tech. Commun.* No. 100, 14 pp.

Poultry Science

- DU PREEZ, J.J., WESSELS, J.P.H., STOKOE, S.A. & VAN DER MERWE, P.W.A., 1971. Die verwantskap tussen vog, vet en proteïen in die karkasse van verskillende tipes pluimvee. *Agroanimalia* 3, 35.
- JOUBERT, J.J. & LE ROUX, D.P., 1971. Die effek van seleksie op genetiese parameter by braaihoenders. *Proc. S. Afr. Soc. Genet.* 4th Congress pp. 48–54.
- MARAI, C.L., South African guinea fowl. *Proc. S. Afr. Soc. Genet.* 4th Congress pp. 46–47.
- OLVER, M.D., 1971. Artificial insemination and duration of fertility in Chinese geese. *Agroanimalia* 3, 79–85.

- ANDERSON, P.J.S. & VERSTER, ANNA, 1971. Studies on *Dictyocaulus filaria* I. Modifications of laboratory procedures. *Onderstepoort J. vet. Res.* 38, 181-184.
- ANDERSON, P.J.S. & VERSTER, ANNA, 1971. Studies on *Dictyocaulus filaria* II. Migration of the developmental stages in lambs. *Onderstepoort J. vet. Res.* 38, 185-190.
- BARTSCH, R.C., 1971. Alveolitis and pulpitis of the canine tooth in a walrus. *J. Am. vet. med. Ass.* 159, 575-577.
- BARTSCH, R.C., WESSELS, B.C. & McCONNEL, E.E., 1972. Myocardial tuberculoma in a chacma baboon (*Papio ursinus* (Kerr) 1792), *Lab. Anim.* 6, 41-47.
- BASSON, P.A., McCULLY, R.M. & BICALKE, R.D., 1970. Observations on the pathogenesis of bovine and antelope strains of *Besnoitia besnoiti* (Marotel, 1912) infection in cattle and rabbits. *Onderstepoort J. vet. Res.* 37, 105-126.
- BASSON, P.A., McCULLY, R.M., DE VOS, V., YOUNG, E. & KRUGER, S.P., 1971. Some parasitic and other natural diseases of the African elephant in the Kruger National Park. *Onderstepoort J. vet. Res.* 38, 239-254.
- BASSON, P.A., McCULLY, R.M., KRUGER, S.P., VAN NIEKERK, J.W., YOUNG, E. DE VOS, V., KEEP, M.E. & EBEDDES, H., 1971. Disease conditions of game in Southern Africa: Recent miscellaneous findings. *Vet. med. Rev.*, Leverkusen, 2(3), 313-340.
- BELONJE, P.C. & VAN DER WALT, K., 1971. Milk fever in a large Jersey herd. I. The incidence of the condition. *Jl S. Afr. vet. med. Ass.* 42, 135-141.
- BOULOS, B.M., JENKINS, W.L. & DAVIS, L.E., 1972. Pharmacokinetics of certain drugs in the domesticated goat. *Am. J. vet. Res.* 33, 943-952.
- CAMERON, C.M., 1971. Evaluation of serological tests as criteria for immunity to staphylococcal skin infections in rabbits. *Onderstepoort J. vet. Res.* 38, 99-110.
- CAMERON, C.M., 1972. Immunization of sheep against Pasteurellosis. *Jl S. Afr. vet. med. Ass.* 43, 77-81.
- CAMERON, C.M. & ENGELBRECHT, MARIA M., 1971. Mechanisms of immunity to *Corynebacterium pseudotuberculosis* in mice using inactivated vaccine. *Onderstepoort J. vet. Res.* 38, 73-82.
- CAMERON, C.M. & FULS, W.J.P., 1970. Immune response to dead and live *Escherichia coli* vaccines and colostral transfer of immunity to calves and lambs. *Onderstepoort J. vet. Res.* 37, 157-164.
- CAMERON, C.M. & PURDOM, MARY R., 1971. Immunological and chemical characteristics of *Corynebacterium pseudotuberculosis* cell walls and protoplasm. *Onderstepoort J. vet. Res.* 38, 83-92.
- CAMERON, C.M. & SMIT, MARIA C., 1970. Relationship of *Corynebacterium pseudotuberculosis* protoplasmic toxins to the exotoxin. *Onderstepoort J. vet. Res.* 37, 97-104.
- CAMERON, C.M. & SMIT, GERTRUIDA, 1970. Immune response of rabbits, mice and sheep to polyvalent *Pasteurella* vaccine. *Onderstepoort J. vet. Res.* 37, 217-224.
- COFFEE, G.M., VAN ASWEGEN, P.J.M., McCONNELL, E.E. & BASSON, P.A., 1971. Description of a new nasal mite (Acarina: Halarachnidae) and a new record from the Chacma baboon. *Z. angew. Zool.* 58, 185-190.
- COFFEE, G.M. & McCONNELL, E.E., 1971. *Pneumonyssus vocalis* n. sp. (Acarina: Halarachnidae) a new mite from the laryngeal ventricles of the chacma baboon (*Papio ursinus* (Kerr), *Z. angew. Zool.* 58, 265)270.
- DU PLESSIS, J.L., 1970. Pathogenesis of heartwater. I. *Cowdria ruminantium* in the lymph nodes of domestic ruminants. *Onderstepoort J. vet. Res.* 37, 89-96.
- DU PLESSIS, J.L., 1970. Immunity in heartwater: I. A preliminary note on the role of serum antibodies. *Onderstepoort J. vet. Res.* 37, 147-150.
- DU PLESSIS, J.L. & KUMM, N.A.L., 1971. The passage of *Cowdria ruminantium* in mice. *Jl S. Afr. vet. med. Ass.* 42, 217.
- GERNEKE, W.H., 1971. Robertsonian changes in the chromosomes of a South African rat population (*Rattus rattus* L.) *J. S. Afr. vet. med. Ass.* 42, 129-133.
- GIESECKE, W.H., THEADORIDIS, A. & ELS, H.J., 1971. Pseudo-Cowpox (Paravaccinia) in dairy cows. *Jl S. Afr. vet. med. Ass.* 42, 193-194.
- HAY, G., 1972. Fluorescent antibody staining: Clostridial Spp. *Vet. Clinician* 9, 23.
- HOFMEYR, C.F.B., 1972. Surgery of the Pharynx. *Vet. Clin. N. Am.* 2, 3-16.
- JANSEN, B.C., 1971. The toxic antigenic factors produced by *Clostridium botulinum* types C and D. *Onderstepoort J. vet. Res.* 38, 93-98.
- JANSEN, B.C., 1971. The quantitative determination of the toxic factors produced by *Clostridium botulinum* types C and D. *Onderstepoort J. vet. Res.* 38, 177-180.
- JANSEN, B.C. & KNOETZE, P.C., 1971. Tryptic activation of *Clostridium botulinum* type C β toxin. *Onderstepoort J. vet. Res.* 38, 237-238.
- JANSEN, B.C. KNOETZE, P.C. & VISSER, F., 1970. The antigenicity of *Clostridium botulinum* type C toxin administered *per os*. *Onderstepoort J. vet. Res.* 37, 169-172.
- JENKINS, W.L., 1971. Refresher courses in pharmacology: 4. The biotransformation of drugs. *Jl S. Afr. vet. med. Ass.* 42, 211-216.
- JENKINS, W.L., 1972. Refresher courses in pharmacology: 5. The excretion of drugs. *Jl S. Afr. vet. med. Ass.* 42, 289-292.

- JENKINS, W.L., 1972. Refresher courses in pharmacology: 6. Mechanisms of drug action. *Jl S. Afr. vet. med. Ass.* 43, 9-12.
- JENKINS, W.L., 1972. Clinically significant aspects of comparative pharmacology in veterinary medicine. Proc. Vth Congress of the South African Pharmacological Society. *S. Afr. med. J.* 46(24), 795.
- McCONNELL, E.E., BASSON, P.A. & DE VOS, V., 1971. Nasal acariasis in the Chacma baboon *Papio ursinus* Kerr, 1972. *Onderstepoort J. vet. Res.* 38, 207-214.
- McCONNELL, E.E., BASSON, P.A. & PIENAAR, J.G., 1971. Pneumocystosis in a domestic goat. *Onderstepoort J. vet. Res.* 38, 117-126.
- McCONNELL, E.E., SMIT, J.D. & VENTER, H.J., 1971. Melanoma in the larynx of a dog. *J. S. Afr. vet. med. Ass.* 42, 189-191.
- McCULLY, R.M., BASSON, P.A., PIENAAR, J.G., ERASMUS, B.J. & YOUNG, E., 1971. Herpes nodules in the lung of the African elephant (*Lorodonta africana* (Blumenbach, 1797)). *Onderstepoort J. vet. Res.* 38, 225-232.
- McCULLY, R.M. & NEITZ, W.O., 1971. Clinicopathological study on experimentally produced *Trypanosoma brucei* infection in horses. Part 2. Histopathological findings in the nervous system and other organs of treated and untreated horses reacting to Nagana. *Onderstepoort J. vet. Res.* 38, 141-176.
- NAUDE, T.W., BASSON, P.A. & PIENAAR, J.G., 1970. Experimental diamidine poisoning due to commonly used babecides. *Onderstepoort J. vet. Res.* 37, 173-184.
- NEITZ, W.O. & McCULLY, R.M., 1971. Clinicopathological study on experimentally produced *Trypanosoma brucei* infections in horses. Part I. Development of clinically recognisable nervous symptoms in nagana-infected horses treated with subcurative doses of Antrypol and Berenil. *Onderstepoort J. vet. Res.* 38, 127-140.
- OELLERMAN, R.A., 1970. Plaque formation by African horsesickness virus and characterization of its R.N.A. *Onderstepoort J. vet. Res.* 37, 137-144.
- OSTERHOFF, D.R., 1972. Haemoglobin types and the geeldikkopenzootic icterus complex in sheep. *Anim. Blood Grps. biochem. Genet.* 2, 1971, 181-184.
- REINECKE, R.K., COLLINS, H. MARIA & ANDERSON, P.J.S., 1971. Studies on *Dictyocaulus filaria*. III. The migration of the immature stages applied to an anthelmintic test. *Onderstepoort J. vet. Res.* 38, 191-198.
- SCHUTTE, A.P., McCONNELL, E.E. & BOSMAN, P.P., 1971. Vibronic abortion in ewes in South Africa: Preliminary report. *Jl. S. Afr. vet. med. Ass.* 42, 223-226.
- SCHUTTE, J.A., WILKE, P.I. & COMPAAN, J.P., 1971. Surgical procedure for the creation of an oesophageal fistula in a sheep. *Agroanimalia* 3, 99-102.
- VAN DEN HEEVER, L.W., 1971. Biologiese en chemiese besmetting van proteïenvoedsel van diere-oorsprong. In: *Proteins and Food Supply*. Edited by J.W. Claassens and H.J. Potgieter. Cape Town: A.A. Balkema.
- VAN DEN HEEVER, L.W., 1972. Antibiotic resistance and R-factors in *Echerichia coli* from calves, meat and milk. *Jl. S. Afr. vet. med. Ass.* 43, 71-75.
- VAN RENSBURG, I.B.J. & DU PLESSIS, J.L., 1971. Nosematosis in a cat: A case report. *J. S. Afr. vet. med. Ass.* 42, 327-331.
- VAN ROOYEN, P.J., MUNZ, E.K., & WEISS, K.E., 1969. The optimal conditions for the multiplication of Neethling-type Lumpy Skin Disease virus in embryonated eggs. *Onderstepoort J. vet. Res.* 36, 165-174.
- VAN WARMELO, K.T., MARASAS, W.F.O., ADELAAR, T.F., KELLERMAN, T.S., VAN RENSBURG, I.B.J. & MINNE, J.A., 1970. Experimental evidence that lupinosis of sheep is a mycotoxicosis caused by the fungus *Phomopsis leptostromiformis* (Kühn) Bubak. *Proc. Symposium Mycotoxins in human health*. Editor I.F.H. Purchase, London: Macmillan Press, Ltd.
- VAN WYK, J.A., 1971. Studies on schistosomiasis. 1. An improved method of concentrating miracidia. *Jl. S. Afr. vet. med. Ass.* 42, 169-170.
- VAN WYK, J.A., 1971. Studies on schistosomiasis. 2. An improved technique for counting ova and cercariae. *Jl S. Afr. vet. med. Ass.* 42, 171-173.
- VAN WYK, J.A., 1971. Rabies in Otavi and Tsumeb, South West Africa. *Jl S. Afr. vet. med. Ass.* 42, 237-241.
- VAN WYK, J.A., 1971. Kitsdiagnose van Bilharzia (Rapid diagnosis of Bilharzia). *Jl S. Afr. vet. med. Ass.* 42, 378.
- VAN WYK, J.A. & BARTSCH, R.C., 1971. Stootsiektesindroom by eksperimentele hiperergiese schistosomiasis (staggers syndrome in experimental hiperergic schistosomiasis). *Jl S. Afr. vet. med. Ass.* 42, 272.
- VERSTER, ANNA, COLLINS, H. MARIA & ANDERSON, P.J.S., 1971. Studies on *Dictyocaulus filaria*. IV. The morphogenesis of the parasitic stages applied to an anthelmintic test. *Onderstepoort J. vet. Res.* 38, 199-206.
- VERWOERD, D.W., 1970. Failure to demonstrate *in vitro* as opposed to *in vivo* transcription of the bluetongue virus genome. *Onderstepoort J. vet. Res.* 37, 225-228.
- VERWOERD, D.W., ELS, H.J., HUISMANS, H. & LOUW, H., 1971. Transkripsie van die bloutongvirusgenoom. *Proc. 4th Cong. S. Afr. genet. Soc.* (Pretoria 1970).

- VINHA, N.A. & COUBROUGH, R.I., 1972. Deep freezing of ram semen. *Jl. S. Afr. vet. med. Ass.* 43, 43.
- WARD-COX, I.S., 1971. The preparation of broad spectrum antisera for use in the characterisation of serum proteins by immunodiffusion techniques (Research note) *Jl S. Afr. vet. med. Ass.* 42, 185.
- WETZEL, H., NEVILL, E.M., & ERASMUS, B.J., 1970. Studies on the transmission of African horsesickness. *Onderstepoort J. vet. Res.* 37, 165–168.
- WORTHINGTON, R.W., 1971. Histone-serum protein interactions. *S. Afr. med. J.* 45, 580.
- WORTHINGTON, R.W., VAN TONDER, E.M., & MÜLDERS, MARIA S.G., 1972. The incidence of *Brucella ovis* infection in South African rams: A serological survey. *Jl S. Afr. vet. med. Ass.* 43, 83–85.
- Viticulture**
- AUGUSTYN, O.P.H., VAN WYK, C.J., MULLER, C.J., KEPNER, R.E. & WEBB, A.B., 1971. The structure of Solerone [5-Acetyldihydro -2 (3H) – furavone], a substituted gamma lactone involved in wine aroma. *J. agric. Fd. Chem.* 19, 1 128–1 130.
- Zoology**
- ARGO, ANNE-DOROTHEE & VAN DEN BERG, ESTHER, 1971. Three new species of the genus *Kochinema* (Nematoda Dorylaimoidea) from South Africa. *Phytophylactica* 3, 45–50.
- BASSON, N.C.J., 1970. Toksisiteit van dieldrin teenoor die skerpioen. *Cheloctonus jonesi* Pocock. *Phytophylactica* 2, 171–176.
- BASSON, N.C.J., 1970. Invloed van dieldrin op die duisendpoot *Alboporus* sp. (*Juliformia Spirostreptidae*) *Phytophylactica* 2, 217–220.
- FINDLAY, J.B.R., 1970. The effect on the scorpion *Cheloctonus jonesi* Pocock (Scorpionidae), of insecticidal baits broadcast in the field for the control of the harvester termite *Hodotermes mossambicus* Hagen. *Phytophylactica* 2, 213–214.
- HEYNS, J., 1970. South African Criconematinae. Part 3. More species of *Hemicriconemoides* and *Macroposthonia* (Nematoda) *Phytophylactica* 2, 243–250.
- KLEYNHANS, K.P.N., 1970. New records and species of Dorylaimoidea (Nematoda) from South Africa. *Phytophylactica* 2, 251–262.
- MILNE, D.L., 1972. Lesion nematodes as a potential threat to South African citrus. *Citrus Grow. & Subtrop. Fruit J.* 461, 11–14.
- MILNE, D.L., 1972. Nematode diseases of tobacco. In: *Economic Nematology*, Ed. J.M. Webster. London: Academic Press. 159–186.
- VAN DEN BERG, ESTHER, 1971. The rootlesion nematodes of South Africa (Genus *Pratylenchus* family Hoplolaimidae) *Tech. Commun. No. 99, Dep. agric. tech. Serv., Repub. S. Afr.*
- VAN DEN BERG, ESTHER & HEYNS, J., 1970. South African Hoplolaiminae. I. The Genus *Hoplolaimus* Daday, 1905. *Phytophylactica* 2, 221–226.
- (6) POPULAR PUBLICATIONS**
- FARMING IN SOUTH AFRICA*
- Agronomy**
- CRAFFORD, D.J., NOTT, R.W., Jul. 1971. Soil, rainfall and maize silage yield
- DE JAGER, Dr J.M., Oct. 1971. How to beat the weather
- DIPPENAAR, M.C., March 1972. Early maturity – early harvesting
- FARINA, Dr M.P., Nov. 1971. Beware of sulphur deficiencies
- GROBBELAAR, W.S., Sept. 1971. Lupins in the Winter Rainfall Region
- HAMMES, P.S., Jul. 1971. Seed size in maize
- HAMMES, P.S., June 1972. Pearl millet – the topnotch forage crop
- HULME, prof. S.A., Jul. 1971. High-lysine maize its pros and cons
- STRAATMAN, H.J., BIRCH, E.B., Marshall, R.J., Jan. 1972. Lupins thrive in Eastern Cape
- VAN DER MERWE, P.J.A., FOSTER, T.W., March 1972. Cotton diseases and their control
- Oct. 1971. Amino acid plays role in disease
- March 1972. Cost of cotton production on irrigated lands
- Oct. 1971. Drip irrigation – new advances
- Sept. 1971. New pesticide for black root rot
- Oct. 1971. New record maize yield
- Nov. 1971. New types of aphids attack wheat
- March 1972. New planter for wheat and small grain
- Nov. 1971. Lush maize crops on weeping love-grass pastures
- Oct. 1971. Land-use for crops
- Crops**
- VAN DER MERWE, J.J., Dec. 1971. Maize farmers – plant metric
- Dec. 1971. Grain farmers, relax
- Economy**
- SCHOEMAN, H., Oct. 1971. Why yellow margarine?
- Oct. 1971. New wool mark launched

Editorial

Jul. 1971. Crops and the future
March 1972. The Hendrik Verwoerd dam
Aug. 1971. New permit quota system for slaughterstock
Nov. 1971. Our new Departmental Head
Sept. 1971. Planter test reports — a great milestone
Febr. 1972. The potential of our agriculture
Nov. 1971. South Africa and the E.E.C.
Jan. 1972. Stock reduction — closing scheme
May 1972. Aids in livestock Industry
April 1972. The Agricultural report

Financial

Jan. 1972. Farmer saves labour with larger tractors
Jan. 1972. Financial aid for farmers in the Eastern Cape
Sept. 1971. Financial aid to farmers during drought is changed
Sept. 1971. Trends in foreign Agriculture
Sept. 1971. More grain for export
Sept. 1971. Our farmers earn more
Sept. 1971. S.A. Reserve Bank
NIEUWOUDT, Dr W.L., Jan. 1972. Our farmers are rational

General

BOTHA, dr J.P., Febr. 1972. Harris — where the tweed comes from
SCHUTTE, L., Febr. 1972. Project water-hail becomes countrywide
WINGATE, L.R., Oct. 1971. Bat — farmer's friend or foe?
ZUMPT, dr I.F., DE LA HARP, dr P., Oct. 1971. Beware of rabies
Oct. 1971. Dreaded rabies claims another victim
Aug. 1971. Inflated warehouse
Dec. 1971. New Directors
Aug. 1971. New wine separator
Oct. 1971. University Pretoria wins a tractor
Oct. 1971. Winners of Rand Spring Show

Grazing

EDWARDS, P.J., COETZEE, G., Nov. 1971. Dividing veld into units
COETZEE, G., EDWARDS, P.J., Nov. 1971. Growth vigour and capacity of veld
COETZEE, G., EDWARDS, P.J., Nov. 1971. How much rest does the veld need?
LE CLUS, C.F., OPPERMAN, D.P.J., NEL, J.C., Febr. 1972. How much to spend — when combating termites?
COETZEE, G. EDWARDS, P.J., Nov. 1971. Planning a veld control system

NEL, S.J.C., VAN ASWEGEN, F.F.M., Jul. 1971. Harvester termites in a three-camp system
DE KOCK, M.D., Jul. 1971. Satansbos, a very noxious weed

Horticulture

BARTHOLOMEW, P.E., Jul. 1971. Inoculation and pelleting of legume seed
BRODRICK, H.T., Aug. 1971. *Armillaria mellea* in banana plantations
BRODRICK, H.T., Aug. 1971. Mango diseases
BRODRICK, H.T., KÜHNE, F.A., Oct. 1971. Sigatoka in bananas can be profitably controlled
BROODRYK, S.W., Aug. 1971. Controlling cotton insects
DE VILLIERS, E.A., Jan. 1972. Which pests attack granadillas?
ENGELBRECHT, D.J., Jun. 1972. Strawberry farmers — beware of virusses
JACKSON, D.C., Jun. 1972. Use foliar feeding for plants
KÜHNE, F.A., Jan. 1972. Banana beetle borer creeps into the Transvaal
KÜHNE, F.A., Febr. 1972. Avoid too strong fumigant for bananas
LANGENEGGER, W., DU PLESSIS, S.F., KOEN, T.J., Jul. 1971. Bananas — their soil and nutritional requirements
LE ROUX, J.C., Jun. 1971. Stump topworking of old pecan trees
MAREE, P.C.J., Jul. 1971. Carrot seed from the Little Karoo
MAREE, P.C.J., LÖTTER, B.F., Aug. 1971. Cauliflower seed from the Little Karoo
ROBERTSON, B.L., DALLDORF, D.B., HARRISON, R.A., Nov. 1971. Pre-harvest ripening of pineapples
SCHWARTZ, A., Dec. 1971. New headache for banana farmers
SMITH, J.H.E., JOUBERT, A.J., Febr. 1972. Mango farmers — plan in good time (1)
SMITH, J.H.E., March 1972. Mango farmers — plan in good time (2)
WENTZEL, P.C., Sept. 1971. Thrips discovered on macadamia nuts
WOLSTENHOLME, dr B.N., Dec. 1971. The ecology of the pecan tree
WOLSTENHOLME, dr B.N., Jun. 1972. More pecans through close spacing and pruning
Oct. 1971. Attention coffee farmers
Febr. 1972. Coffee farmers — spray for rust
Jan. 1972. Export of cutflowers
Oct. 1971. Greening, threat to citrus
March 1972. Interest in olives increasing
March 1972. Leaf analysis for bananas
Jan. 1972. Outstanding yields from young appletrees
Jun. 1972. Release of the first locally bred plum cultivar Songold

Jan. 1972. Export of cutflowers
 Febr. 1972. Ripener only a bluff
 Sept. 1971. Shoots without virus
 June 1972. Warning against parathion residues on citrus
 June 1972. Fertilize peas advantageously
 June 1972. Songold, die nuwe pruimsoort
 Jan. 1972. Bitter pit: spray calcium

Irrigation

BADENHORST, J.W., May 1972. Irrigate correctly and save water
 MYER, J.G.L., Jan. 1972. Practical plans for the irrigation farmer
 SIERTSEMA, J.K., July 1971. Irrigation — when?

Livestock

BOTHA, dr J.P., Dec. 1971. Do the Jacob sheep come from S.A.?
 HOFMEYER, Dr J., Jan. 1972. What is the future of the Karakul industry?
 JACOBSZ, J.Z.H., UECKERMANN, L., GROENEWALD, W.H.L., FOURIE, J.A.C., Dec. 1971. Fattening can be profitable
 JAMNECK, M.J.C., Febr. 1972. Abbatoirs throughout the country to be improved
 KRUGER, C.D., Aug. 1971. Beef production — when is it profitable?
 MAREE, C., VENTER, H.A.W., Febr. 1972. Farmers look after your bulls
 MEAKER, H.J., Nov. 1971. Flushing and the lamb crop
 MULDER, A.M., TERBLANCHE, I.L., NEL, L.P., Febr. 1972. Use the rubberring to dock Dorper lambs
 PENZHORN, E.J., June 1972. Finish your beef cattle judiciously
 PIETERSE, P.J.S., Aug. 1971. Drought feeding — basic principal
 SHORT, A.M., WOODHOUSE, C.D., Aug. 1971. Maize silage: best winter feed for Merino ewes
 VAN SCHALKWYK, S.A.D., Dec. 1971. The wool industry
 VENTER, J.J., Nov. 1971. Slump in wool prices — what now?
 VOSLOO, W.A., Aug. 1971. Pigs — their management and feeding
 March 1972. Boer goats do well on shrub grazing
 Oct. 1971. Flexible eartags
 Feb. 1972. How selectively do livestock graze?
 Feb. 1972. Maintaining hygiene at abattoirs
 Aug. 1971. Self-heating pigsty
 Aug. 1971. Top Hereford for S.A.
 Aug. 1971. Vaccine for pregnant animals
 Feb. 1972. White-wooled mutton sheep is progressing

Mechanisation

DEPT. AGRIC. ENG., Sept. 1971. Official report on planters
 Sept. 1971. Different kinds of planters
 June 1972. Official reports on Fertiliser Spreader

Meteorology

SNYMAN, A., Jan. 1972. Giant plan to bring rain and stop hail

Planning

Apr. 1972. Satellite photography will speed up land-use planning
 Apr. 1972. First plots on Makatinti prepared

Poultry

OLVER, M.D., Aug. 1971. Has the goose a future?
 OLVER, M.D., Sept. 1971. Split wing in Chinese geese
 OLVER, M.D., Apr. 1972. How many geese to a gander?

Special

BOTHA, Dr J.P., June 1972. Living fossils
 DE LA HARPE, DE VILLIERS., Oct. 1971. Organised agriculture bids farewell to Dr Vorster
 DU PLESSIS, Dr S.J., VAN VUREN, J.P.J., March 1972. Agriculture under the searchlight
 VERBEEK, Dr W.A., Nov. 1971. S.A. agriculture in the seventies
 VORSTER, Dr P.W., Oct. 1971. A few words of farewell
 Oct. 1971. Award to Dr P.W. Vorster
 March 1972. Entering a new era
 Dec. 1971. Fishing on your farm — for pleasure or profit
 June 1972. Foskor — 21 years of service to agriculture
 Nov. 1971. Measures against pollution — wide investigation
 Dec. 1971. Our flying visit to a trout farm
 Dec. 1971. Season's message from Minister
 March 1972. Short courses during 1972
 March 1972. Special courses during 1972
 March 1972. University of Pretoria's new agricultural Building
 Oct. 1971. Vorster, Dr P.W. — Agriculturalist and Secretary 1930-1971
 Oct. 1971. Vorster, Dr P.W. — A tribute

Veterinary Science

Sept. 1971. Leptospirosis: vaccine now available

Beauty

DICKASON, B., Jan. 1972. Make the most of yourself

Book reviews

LUYT, V., Jan. 1972. "Keramiek tuis"

VAN DER SPUY, U., Jan. 1972. Wild flowers of the S.A. Gardens

Fashion

HOUGHTON, N., Jan. 1972. Jo-Ann is "with-it" at varsity

VAN HOEPEN, B., Aug. 1971. Fads of fashion (1)

Sept. 1971. Fads of fashion (2)

Oct. 1971. Fads of fashion (3)

Nov. 1971. Fads of fashion (4)

Dec. 1971. Fads of fashion (5)

Jan. 1972. Fads of fashion (6)

WOEST, H., Jan. 1972. A chic stitched hat

WOEST, H., Jan. 1972. A pattern for your hat

Dec. 1971. Fashion hits

Dec. 1971. Femininity is the watchword

July 1971. For mid-winter

March 1972. Here we are — woolly warmth in the very new look

June. 1972. Woollen knitwear now machine washable

June 1972. White for winter

General

VAN VUREN, J.J., Nov. 1971. Your wedding day

Handicraft

HATTINGH, S., March 1972. Crochet terms of various countries

LATEGAN, E., Dec. 1971. Can they really be dried flowers?

Jan. 1972. Can they really be dried flowers?

Febr. 1972. Can they really be dried flowers?

WILBY, P., June 1972. Facing and inter-facing

Hearth and home

DU PLESSIS, A., Aug. 1971. Let's visit the Clock Centre

DU PLESSIS, A., Sept. 1971. Furniture parade

DU PLESSIS, A., Sept. 1971. Let's go Spanish

DU TOIT, C., Nov. 1971. Cook without water — if you wish

DU TOIT, C., Nov. 1971. Get to know stainless steel

DU TOIT, C., Febr. 1972. The sponge that grows on trees

HOFMEYR, M., July 1971. Banish those wash-day blues

LATEGAN, E., Oct. 1971. Buying a dishwasher

LATEGAN, E., Dec. 1971. A room for the laundry

LATEGAN, E., Nov. 1971. Start saving for a micro-wave oven

LATEGAN, E., Nov. 1971. Today I am buying a polisher

LATEGAN, E., Feb. 1972. Away with those stains (1)
March 1972. Away with those stains (2)

LATEGAN, E., March 1972. Look after leather

LATEGAN, E., Nov. 1971. Which washing-machine shall I buy?

MALLANDAIN, D., July 1971. Choosing a knitting machine

MALLANDAIN, D., Sept. 1971. "Vegetables" for the kitchen

NEETHLING, J., July 1971. There is a time for everything

UYS, S., March 1972. Here are the answers

VISSER, G., July 1971. Picking porcelain

VAN DEN BERG, R., Dec. 1971. The pressure cooker

VAN MARLE, W., Febr. 1972. Create with your machine

VAN VUREN, J., Febr. 1972. Crochet is fun

VAN VUREN, J., Oct. 1971. A personal touch this Christmas

VAN VUREN, J., Oct. 1971. "Topsy" is made of string

WILBY, P., July 1971. Let's take care of that chair

Dec. 1971. A perfumed present

Dec. 1971. Right for the rain

Home economics

HOFMEYR, M., Jan. 1972. Cash or credit?

NEETHLING, J., March 1972. Balance your income and expenditure

NEETHLING, J.E., Jun. 1972. Plan your budget

Let's talk it over

KRIEL, A., July 1971. The vocation of the farmer's wife (1)

KRIEL, A., Aug. 1971. The vocation of the farmer's wife (2)

VAN HOEPEN, B., Oct. 1971. Kings of the earth

VAN HOEPEN, B., Nov. 1971. Water, water everywhere

VAN HOEPEN, B., Dec. 1971. I love to be messy

VAN HOEPEN, B., Jan. 1972. Let's become a child again

VAN HOEPEN, B., June 1972. That inferiority complex

Radio talks

DEPT. OF EDUCATION, Aug. 1971. Paintings for your home

DU TOIT, C., July 1971. Dress your window with care

DU TOIT, C., Sept. 1971. Oven dishes at your service

LATEGAN, E., Aug. 1971. Home-made mixes

LATEGAN, E., Metrication

Recipes

- BADENHORST, C., Feb. 1972. Eggfruit, brinjal or aubergine?
- BRINK, L., July 1971. Cooking for two is fun
- CLAASSENS, M., Oct. 1971. A "do" with a difference
- CLAASSENS, M., Oct. 1971. Chocolate cakes
- CLAASSENS, M., July 1971. Sweets for the sweet
- DU TOIT, C., Feb. 1972. Do you know chestnuts?
- DU TOIT, M., Feb. 1972. Mind the bones
- HUGO, C., Dec. 1971. Start the year with a picnic
- LATEGAN, E., June 1972. Soft lights, wine and fondue
- LATEGAN, E., June 1972. Waffles — a sweet challenge
- LOMBARD, E., Dec. 1971. Super soufflés
- NEETHLING, J., Dec. 1971. Don't entertain me to death
- SMITH, E., Dec. 1971. Rita entertains after office hours
- VAN DEN BERG, R., Aug. 1971. Unbaked biscuits
- VAN DER MERWE, R., June 1972. See that granny and grandpa eat well
- June 1972. Metricated recipes
- VAN VUREN, J., Aug. 1971. Delicious fricadels
- VAN ZYL, A., Jan. 1972. Cook for tomorrow

Special

- DEPT. NAT. EDUCATION, June 1972. Home economics as a career
- VAN VUREN, J., June 1972. She leads a double life

(7) NON-DEPARTMENTAL PUBLICATIONS

- ALLAN, P. 1972. The Future for macadamia nuts, Part 2. *Citrus Grower & Subtrop. Fruit J.* No. 459, 17-21.
- ALLAN, P. 1972. Advancing horticulture. Inaugural lecture. Pietermaritzburg: *Univ. of Natal Press*. 15 pp.
- ANDERSON, R.H., 1972. Pollination. *S. Afr. Bee J.* 43(2), 2-3; 43(3), 3-4.
- BASSON, D.S. & VISSER, A.C., 1972. Ontwatering van volstruisbiltong. *Food Ind. S.A.* 24(10), 18-19, 22.
- BASSON, W.D. & VAN RENSBURG, W.J.J., 1972. Voeding van melkbeeste die bydrae van onderhoudsbehoefes tot voedingskoste. *Die Melkprodusent*, Maart 1972.
- BESTER, B.H., 1972. Indrukke van die suiwelbedryf in Ierland. *S.A. Tydskr. Suiweltegnol.* 4, 43-47.
- BESTER, C.W.J., 1971. Aarbei-cultivars vir die winterreënstreek. *Die Sagtevrugteboer* 21, 172-173.
- BEYERS, E.J. & TERBLANCHE, J.H., 1971. Identification and control of trace element deficiencies. I. Zinc deficiency. *Decid. Fruit Grow.* 21, 132-137.

- BEYERS, E.J. & TERBLANCHE, J.H., 1971. Identification and control of trace element deficiencies. II. Manganese deficiency and toxicity. *Decid. Fruit Grow.* 21, 167-171.
- BEYERS, E.J. & TERBLANCHE, J.H., 1971. Identification and control of trace element deficiencies. III. Copper deficiency. *Decid. Fruit Grow.* 21, 199-202.
- BEYERS, E.J. & TERBLANCHE, J.H., 1971. Identification and control of trace element deficiencies. IV. Boron deficiency and toxicity. *Decid. Fruit Grow.* 21, 235-239.
- BEYERS, E.J. & TERBLANCHE, J.H., 1971. Identification and control of trace element deficiencies. V. Iron deficiency. *Decid. Fruit Grow.* 21, 265-268.
- BEYERS, E.J. & TERBLANCHE, J.H., 1971. Identification and control of trace element deficiencies. VI. Magnesium deficiency. *Decid. Fruit Grow.* 21, 305-309.
- BLOMMAERT, K.L.J., 1971. Groeireguleerders in vrugteverbouing. *Droëvrugte* 3(4), 23-24.
- BLOMMAERT, K.L.J., 1972. Boegoe — moeilik verbou maar baie waardevol. *Boerd. S.A.* 48(12), 10-16.
- BOTHA, P.R., Bedryfsvergelyking as bestuurshulpmiddel by koöperatiewe wynkelders. *Wynboer*, Maart 1972.
- BOTHA, P.R., Wat kan 'n wynkelder leer van 'n ander wynkelder? 'n Praktiese voorbeeld. *Wynboer*, April 1972.
- BOTHA, P.R., Die funksies van direksielede en bestuurders van Koöperatiewe Wynkelders. *Wynboer*, Mei 1972.
- BOTHA, P.R., Die noodsaaklikheid van betroubare inligting vir goeie besluite by wynkelders. *Wynboer*, Junie 1972.
- BREDELL, G.S., 1971. Waterverbruik van sommige subtropiese vrugtesoorte. *The Citrus and Sub-tropical Fruit Journal*, 456, 15-20.
- BREDELL, G.S., 1972. Die belangrikheid van goed geselekteerde bome. *The Citrus and Sub-tropical Fruit Journal* 457, 5-7.
- BURGER, J.D., 1972. Verbouings- en Ekonomiese aspekte van Wyndruifproduksie in Argentinië. *Die Wynboer* 488, 10-11.
- BURGER, J.D., 1972. Arbeidsproduktiwiteit met spesiale verwysing na Wyndruifverbouing. *Die wynboer* 488, 21-24.
- BURGER, J.D., 1972. Wingerdbewerking. *Die Sagtevrugteboer*, 3, 22, 67-69.
- BURGER, W.P., BREDELL, G.S. & CONRADIE, J., 1971. Herplanting van Sitrus: 'n Voorlopige handleiding vir boere. *The Citrus and Sub-Tropical Fruit Journal* 454, 23-25.
- BURGER, W.P. & CONRADIE, J., 1972. The layout of Citrus Orchards. *The Citrus and Sub-tropical Fruit Journal*. 457, 17-19.
- DAIBER, C.C., 1972. Die vernaamste plaë van sierplante en blomme en hulle beheer. *Parke-administrasie* 25(2), 20-24.

- DE KLERK, C.A., 1971. Voorkoms en Verspreiding van Filloksera besmetting in die Olifantsrivier-besproeiingsgebied. Die Wynboer, No. 480: 57-58. (September 1971).
- DE KLERK, C.A., & GILLIOMEE, J.H., 1971. Filloksera: Steeds 'n ernstige probleem in ons wingerde. Die Wynboer, No. 479: 7-9. (Aug. 1971).
- DE KLERK, C.A., 1972. Filloksera weerstandbiedende onderstokke. Die Wynboer, No. 485: 18-20. (Februarie 1972).
- DE VILLIERS, T.T., Vleismerino uiters geskik vir slaglamproduksie. Landbouweekblad 20 Julie 1971.
- DE WET, P.J., VOSLOO, L.P., Die Merino en Vleisramme. Waarheen? "Die Baken" Jaargang 1, Nr. 2. September 1971.
- DU PLESSIS, J.A. & HOLTZHAUSEN, L.C., 1971. Die Tuinbou-afdeling van Messina-proefplaas: 'n Nuwe bate vir die sitrusbedryf. The Citrus and Sub-tropical Fruit Journal. 453, 5-7
- ENGELBRECHT, D.J., 1971. Die betekenis van virusinfeksie in tafeldruiwingerde. Sagtevrugteboer 21, 261-263.
- ENGELBRECHT, D.J. & BESTER, C.W.J., 1971. Veldprestasie van die hittebehandelde Festival-aarbeikloon. Die Sagtevrugteboer 21, 196-198.
- C. ENGELBRECHT, & H.L.J. POTGIETER, Optimum use of rainfall for dry-land crops — Farmer's Weekly 6.10.71.
- G.C. ENGELBRECHT & J. DE KOCK. Wheat: Researchers seek breakthrough — Farmer's Weekly 10.5.72.
- ERASMUS, L.S. Dubbeldoelrasse se toekoms rooskleurig mits Landbouweekblad 20 Julie 1971.
- ESHUYS, W.A., 1971. Die botaniese en geografiese geskiedenis van die geslag sitrus. The Citrus and Sub-tropical Fruit Journal, 452, 17-18.
- HAYWARD, J.J.P. & HANSMANN, C.F., 1972. *Byssochlamys fulva* and the spoilage of canned youngberries. Food. Ind. S.A. 24 (12), 15, 17.
- HEYNS, A.J. & STRYDOM, D.K., 1972. Plantverbetering in Engeland. Jaarblad Appelkoos-, Peer- en Perskekwekersvereniging 45-49.
- HURTER, N., MATTHEE, F.N., VAN TONDER, M.J. & VISAGIE, T.R., 1972. Vrystelling van die eerste plaaslik geteelde pruimcultivar Songold. Die Sagtevrugteboer 22, 77-79.
- JOHANNSMIEIER, M.F., 1971. Sunflowers. S. Afr. Bee J. 42(6), 2-4.
- JOUBERT, J.J., Kalkoenvoeding by intensiewe boerdery I, S.A.P.V. Bulletin, April 1972.
- JOUBERT, J.J. Kalkoenvoeding by intensiewe boerdery II, S.A.V.P. Bulletin, Julie 1972.
- KEMM, E.H., 1971. Praktiese varkvoeding. Die Vleisnywerheid, April-Junie 1971.
- KEMM, E.H., 1971. Die Teelsog. Die Vleisnywerheid, Oktober-Desember 1971.
- KNOX-DAVIES, P.S., 1971. Crop rotation versus disease. Farm Affairs 10(2): 1-2.
- KNOX-DAVIES, P.S., 1971. Organic matter for plant health. Farm Affairs 10(3): 11-14.
- KNOX-DAVIES, P.S., 1971. Wisselbou en plantsiektes. Boerebelange 10(2): 1-2.
- KNOX-DAVIES, P.S., 1971. Organiese materiaal vir gesonde plante. Boerebelange 10(3): 11-14.
- KNOX-DAVIES, P.S., 1972. Koringsiektes in Wes-Kaapland. "Die Baken" 2(3): 17-19.
- LE ROUX, J.J.S., VISSER, A.C. & EKSTEEN, J., 1971. Sondroog van vrugte. Droëvrugte 3(2) 6-52.
- LOMBARD, S.H., 1971. Koeie produseer nie botter nie. Voortou 1971, 29-32.
- MALAN, A.H., 1972. Oesbeheer by tafeldruiwe. Die Sagtevrugteboer 22, 65-66.
- MALAN, A.H., 1972. Moontlike nuwe cultivars ingevoer. Die Sagtevrugteboer 22, 37-38.
- MARAIS, C.L., Kalkoene: Die behuising van dagoud kuikens, S.A.P.V. Pluimvee Bulletin, Januarie 1972.
- MARAIS, C.L. Kunsmatige lig in pluimveehuise, S.A.P.V. Pluimvee Bulletin, Oktober 1971.
- MARAIS, C.L. Minihoender, S.A.P.V. Pluimvee Bulletin, Desember 1971.
- MARAIS, C.L. Kleur verraai kuikens se geslag, Koöperatiewe Boer — Vol. 1 Nr. 5, Augustus 1971.
- MARAIS, P.G., 1971. Die gebruik van isotooptegnieke vir die daarstelling van meer doeltreffende bemestingsprogramme. MVSA Plantvoedselnuus 2, 23-30.
- MATTHEE, F.N., SCHWABE, W.F.S. & VAN DER MERWE, J., 1971. Ontwikkelinge in die beheer van siektes van tafeldruiwe. Die Sagtevrugteboer 21, 226-231.
- MATTHEE, F.N. & ERSKINE, J.M., 1971. Bakteriese kanker van steenvrugte. II. Beheermaatreëls. Die Sagtevrugteboer 21, 204-206.
- MYBURGH, A.C., 1971. The fruit fly. Droëvrugte 3(4), 21-22.
- MYBURGH, A.C., 1971. Chemical control of mealybug on table grapes. Droëvrugte 3(4), 24-25.
- MYBURGH, A.C. & BOSMAN, I.P., 1971. Eksperimentele programme teen rooispinmyt op appels en pere. 1971. Die Sagtevrugteboer 21, 302-303.
- MYBURGH, A.C. & WHITEHEAD, V.B., 1971. Plae van perskes, appelkose en pruime. Die Sagtevrugteboer 21, 141-149.
- MYBURGH, A.C., 1971. Plae van appels en pere. Die Sagtevrugteboer 21, 174-181.
- PIAGET, J. & LUTTICH, J., 1972. Micro-irrigation techniques. A.P.G.A. Annual, 8-11.
- PIENAAR, W.J., DEIST, J. & MOSTERT, E.W., 1972. Brakgehalte van boorgatwater in die Hexvallei. Die Sagtevrugteboer 22, 57-58.

- PIETERSEN, J.P. Nuwe implemente is dubbeltjie se moses
Voer vir die maer jare.
Rûensboer sny sy grond.
Landbouweekblad.
- PIETERSEN, J.P. Hy boer wetenskaplik dog prakties.
Die besproeiingsboer se A's en B's.
Die verbrakking van duur besproeiingsgrond.
- PONGRACZ, D.P., 1972. Wat elke boer en Kweker van die Massa-seleksie van Goeie Wingerdvoorplantingsmateriaal Behoort te Weet. Bladskrif No. 74. Wynkunde- en Wingerdbouereeks No. 1-1972.
- PONGRACZ, D.P., 1971. Affiniteitsprobleme met 101-14 en 143B Onderstokke. Die Wynboer 478, 22.
- PONGRACZ, D.P., 1972. Die huidige posisie met onderstoksoorte. Die Wynboer 489, 16-18.
- PONGRACZ, D.P., 1971. Wingerdbouing in Rhodesië. Die Wynboer 482, 21-22.
- PONGRACZ, D.P. 1972. Hoe kan Cabernet Sauvignon van Cabernet Franc in die praktyk onderskei word? Die Wynboer 486, 17-18.
- PONGRACZ, D.P., 1972. Wynboukundige Eienskappe van Wyndruifsoorte, wat in Suid-Afrika Kommersieël verbou word. Die Wynboer 487, 18-20.
- ROBBERTSE, P.J., 1971. Grafieke help met saadkeuse. Landbouweekblad, 1710, 49-59.
- ROBBERTSE, P.J., 1971. Waarom planteteelt? Voortou, 41-42.
- SCHWABE, W.F.S. & MATTHEE, F.N., 1972. Fusikladium: Die uitwissing van die primêre besmettingsbron. Die Sagtevrugteboer 22, 34-37.
- SKINNER, J.D., 1972. Hoë reproduksie behoort die strewe van elke boer te wees. *Die Vleisnywerheid* 21(1), 33-35.
- SKINNER, J.D., 1971. The real low down about farming with game. *The Farmers' Weekly* Dec. 3rd, pp. 12-17.
- SKINNER, J.D., 1971. Die boerbok is geskik vir intensiewe produksie. *Die Vleisnywerheid* 20(2), 25-28.
- SKINNER, J.D., 1972. Eland vs. beef. Eland cannot compete except in hot semi-arid regions. *Afr. Wild Life* 26, 4-9, 27.
- SMIT, C.J., 1972. Wintersnoei van Hanepoot en Wyndruiwe met verwysing na die Laer Oranjerivier Streek. Droëvrugte 4,1.
- SPIES, L. & VAN DEN BERG, ESTHER. Goue aalwurm in ergste graad. Die Landbouweekblad 22 Junie, 1971: 21 en 27.
- STRYDOM, D.K. & HEYNS, A.J., 1972. Cultivarposisie in V.S.A. en Australië. Jaarblad Appelkoos-, Peer- en Perskekwekersvereniging, 29-33.
- STRYDOM, D.K., HONEYBORNE, G.E. & EKSTEEN, G.J., 1971. Vertraagde bot by kern- en steenvrugte. Die Sagtevrugteboer 21, 126-129.
- SWART, L.G. & KASSIER, W.E., 1971. How long to keep a laying flock. S.A.P.A. Poultry Bull. Oct., 1971.
- SWART, L.G., 1972. Light versus heavy breeds for egg production. S.A.P.A. Poultry Bull. January, 1972.
- SWART, L.G., 1972. Hoeveel hennie per kou? S.A.P.V. Bull. Januarie 1972.
- STOFBERG, J.A. Hoe doeltreffend besproei ons? Wynboer.
- TERBLANCHE, J.H. & DEIST, J., 1971. Ystertekort en die aanvulling daarvan by sagtevrugte. Droëvrugte 3(4), 26-27.
- TERBLANCHE, J.H., WALTERS, J.H. & DEMPERS, P.J., 1971. Late calcium sprays can do harm. Decid. Fruit Grow. 21, 323-325.
- UYS, D.C., 1972. Uitdun van tafeldruiwe. Die Sagtevrugteboer 22, 59.
- VAN DER MERWE, J.J.H. & JOUBERT, D.J., 1971. Die skielike doodgaan van wingerdstokke geënt op Richter 99. Die Wynboer 478, 7.
- VAN DER WESTHUIZEN, J.H. Claassen, F.A., 1972. Vestiging van Nuwe Wingerd onder 'n Plastiese Bedekking. Die Wynboer 489, 9-11.
- VENTER, J.J. & STEENKAMP, C.H., 1971. Classing of wool according to crimp fineness Suppl. to Golden Fleece 1, 9, 19-20.
- VENTER, J.J. & HUGO, W.J., 1972. Difference between the wool of rams wethers and ewes Suppl. to Golden Fleece 1.12, 18-20.
- VISSER, A.C. & WIUM, G.L., 1971. Die ontwatering van pere. Droëvrugte 3(3), 6-7.
- VOSLOO, L.P. So het die S.A. Vleismerino ontstaan. Landbouweekblad 20 Julie 1971.
- VOSLOO, L.P. Die S.A. Vleismerino as wolproduseerder. Landbouweekblad 20 Julie 1971.
- WAGENER, G.W.W., 1972. Word die invloed van Suurstof op Wynkwaliteit nie oorskat nie? Die Wynboer 487, 16-17.
- WHITEHEAD, V.B., 1971. Geïntegreerde plaagbeheer. Die Sagtevrugteboer 21, 311-313.
- WOLSTENHOLME, B.N., 1972. Zinc nutrition of the pecan tree. *Citrus Grower & Subtrop. Fruit J.* No. 459, 25-30.
- WOLSTENHOLME, B.N., 1972. The need for and propagation of clonal rootstocks for pecans, *Proc. Tex. Pecan Grs. Assoc.* 49 (1970), 51-53.
- ZEEMAN, A.S., 1971. Oplei van Wyndruiwe. Die Wynboer. 479, 20-24.

(8) NEW LEGISLATION

During the year under review the following legislation was passed by Parliament:

- 17/1972 — Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Amendment Act, 1972.
- 19/1972 — Veterinary Amendment Act, 1972
- 35/1972 — Tobacco and Wine Research Accounts Amendment Act, 1972
- 36/1972 — Animal Slaughter, Meat and Animal Products Hygiene Amendment Act, 1972
- 37/1972 — Agricultural Research Account Amendment Act, 1972

62/1972 — Wine, Other Fermented Beverages and Spirits Amendment Act, 1972

The extension of the agricultural legislation of the Republic of South Africa to South West Africa was continued on a selective basis and the following acts were applied to that area during the year under review:

1. The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947).
2. The Veterinary Act, 1933 (Act 16 of 1933)
3. The Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967).